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	Telecommunications Technologies and Systems/ Engineer Applied Electronics/Engineer
1.7 Form of education	Full time
1.8 Subject code	TST-E18.00/EA-E18.00

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	Assoc. Prof. Cristian Farcas, Ph.D. – cristian.farcas@ael.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assoc. Prof. Cristian Farcas, Ph.D. – cristian.farcas@ael.utcluj.ro Assist. Prof. Ionut Ciocan, Ph.D. – ionut.ciocan@ael.utcluj.ro						
2.5 Year of study	II	2.6 Semester	1	2.7 Assessment	E	2.8 Subject category	DD/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	42	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. Use of the fundamental elements related to devices, circuits, systems, instrumentation and electronic technology C4. Design, implementation and operation of data, voice, video and multimedia services. This is based on the understanding and the application of fundamental concepts in telecommunications and transmission of information C5. Selecting, installing, configuring and operating fixed or mobile telecommunications equipment. Equipping a site with usual telecommunications networks C6. Solving specific problems of the broadband communications networks: propagation in different environment, circuits and equipment for high frequencies (microwaves and optical).
Transversal competences	N/A

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. 1. Acquiring skills for the use of laboratory equipment.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. 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
2. Matter structure and bonding		
3. Electronic band theory of solids		
4. Classification of materials - conductors, insulators, semiconductors		
5. Dielectric materials – definitions, classifications and general aspects		
6. Fundamental properties of dielectrics		
7. Applications of dielectrics		
8. Breakdown of dielectrics. Dielectric materials used in electronics.		
9. Semiconductor materials – definitions, classifications and general aspects		
10. Intrinsic semiconductors		
11. Extrinsic semiconductors		
12. PN junction. Some semiconductors used in electronics.		

13. Conductors		
14. Magnetic materials. Preparation for the final exam.		

Bibliography

1. C. Farcas Cristian – Materiale pentru electronica, Ed. Risoprint, Cluj-Napoca, 2009
2. R. Cret – Materiale pentru electronica, U.T. Press, Cluj-Napoca, 2004
3. D. Pitica, M. Radu - Componente electronice pasive, Litografia UTC-N, 1994
4. D. Schroder – Semiconductor Material and Device Characterization, John Wiley & Sons, 2006
5. Yu P., Cardona M. – Fundamentals of Semiconductors. Physics and Materials Properties, Springer, 2010.

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

Bibliography

1. V. Pop, I. Chicinas, N. Jumate – Fizica materialelor. Metode experimentale, Presa Universitara Clujeana, 2001
2. R.S. Popovic, Hall Effect Devices - 2nd ed., Bristol; Philadelphia: Institute of Physics, 2004.
3. B. Zeghbroeck, Principles of Semiconductor Devices and Heterojunctions, Paperback - 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 are in agreement with the expectations of the professional Competences acquired will be used in the following COR occupations (Electronics Engineer; Telecommunications Engineer; Electronics Design Engineer; System and Computer Design Engineer; Communications Design Engineer) or in the new occupations proposed to be included in COR (Sale Support Engineer; Multimedia Applications Developer; Network Engineer; Communications Systems Test Engineer; Project Manager; Traffic Engineer; Communications Systems Consultant).

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*

Data of filling in:	**Responsible**	**Title First name SURNAME**	**Signature**
20.06.2023	Course	Assoc. Prof. Cristian Farcas, Ph.D.	
	Applications	Assoc. Prof. Cristian Farcas, Ph.D.	
		Assist. Prof. Ionut Ciocan, Ph.D.	

Date of approval in the Council of the Communications Department 11.07.2023	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of the Faculty of Electronics, Telecommunications and Information Technology 12.07.2023	Dean Prof. Ovidiu POP, Ph.D.