SYLLABUS

1. Data about the program of study

1.1	Institution	The Technical University of Cluj-Napoca
1.2	Faculty	Electronics, Telecommunications and Information Technology
1.3	Department	Applied Electronics
1.4	Field of study	Electronics and Telecommunications Engineering
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-E20.00, EA-E20.00

2. Data about the subject

2.1	Subject name					Materials for Electronics					
2.2	Subject area					Electronics and Telecommunications Engineering					
2.3	Course responsible/lecturer					Assoc. Prof. Cristian Farcas, PhD					
2.4	Teachers in charge of applications					Assoc. Prof. Niculaie Palaghita, PhD Assistant Ionut Ciocan, PhD					
2.5	Year of study	II	2.6	Semester	1	2.7	Assessment	V	2.8	Subject category	DID/DOB

3. Estimated total time

Year/ Sem.	Subject name	No. of weeks	Course [hours/week]	Applications [hours/week] S	Applications [hours/week] L	Applications [hours/week] P	Course [hours/sem.]	Applications [hours/sem.] S	Applications [hours/sem.] L	Applications [hours/sem.] P	Indiv. study [hours/sem.]	TOTAL	Credits
II / 1	Materials for Electronics	14	2		1		28		14		62	104	4

3.1	Number of hours per week	3	3.2	of which, course	2	2	applications	1
3.4	Total hours in the curriculum	42	3.5	of which, course	28	3.6	applications	14

Individual study	Hours
Manual, lecture material and notes, bibliography	28
Supplementary study in the library, online and in the field	-
Preparation for seminars/laboratory works, homework, reports, portfolios, essays	28
Tutoring	3
Exams and tests	3
Other activities	0

3.7	Total hours of individual study	62
3.8	Total hours per semester	104
3.9	Number of credit points	4

4. Pre-requisites (where appropriate)

4.1	Curriculum	N / A
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 applications	Laboratory, Cluj-Napoca

6. Specific competences

Professional competences	Theoretical knowledge (what the student must know):	The student must know: ✓ Matter structure and lattice defects; ✓ classification of materials - conductors, insulators, semiconductors; ✓ properties of dielectrics and their applications; ✓ breakdown in dielectrics; ✓ classification of semiconductors; ✓ intrinsic and extrinsic conduction; ✓ properties and applications of semiconductors; ✓ electrical conductions in metals; ✓ properties of magnetic materials and their applications;
	Acquired skills (what the student is able to do):	After completing the discipline, the students will be able to: ✓ recognize different types of materials; ✓ determine different parameters of capacitors; ✓ distinguish different types of magnetic materials; ✓ determine different parameters of a conductive materials; ✓ use pn junction as temperature sensor;
	Acquired abilities: (what type of equipment the student is able to handle)	After completing the discipline, the students will be able to: ✓ use the lab instrumentation (power supply, oscilloscope, function generator, multimeter) for the experimental studies; ✓ determine relative dielectric constant; ✓ display on an oscilloscope the hysteresis curve of a magnetic core; ✓ display the voltage vs current characteristic of electronic devices;
	In accordance with Grila1 and Grila2 RNCIS	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 (Grila1 and Grila2 RNCIS)		N.A.

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

7.1	General objectives	Developing the competences regarding the use and analysis of electronic materials.
7.2	Specific objectives	1. Developing skills and abilities necessary for the use of the electronic materials. 2. Developing skills and abilities for the use of the 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.		
8.2. Applications (lab)		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. 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.

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

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. Evaluations

Activity type	10.1	Assessment criteria	10.2	Assessment methods	10.3	Weight in the final grade
Course		The level of acquired theoretical knowledge and practical skills		- Summative evaluation written exam (theory and problems)		- E, max 10 pts. 80%
Applications		The level of acquired abilities		- Continuous formative evaluation - practical lab test		- L, max. 10 pts. 20%
10.4 Minimum standard of performance						
$L \geq 5$ and $E \geq 4.5$ and $0,8E+0,2L \geq 4.5$						

Date of filling in
29.01.2015

Course responsible
Assoc. Prof. Cristian Fărcaş, PhD

Teachers in charge of applications
Assoc. Prof. Niculaie Palaghita, PhD
Assist. Ionuţ Ciocan, PhD

Date of approval in the department
29.01.2015

Head of department
Prof. Dorin Petreuş, PhD