SYLLABUS

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Applied Electronics
1.4 Field of study	Electronics Engineering, Telecommunications and Information Technology
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Telecommunications Technologies and Systems/ Engineer
1.7 Form of education	IF-Full time
1.8 Subject code	TST-E108.00

2. Data about the subject

2.1 Subject name	Electronic Microsystems Technology						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Assist. Prof. Mihai DARABAN, Ph.D – mihai.daraban@ael.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assist. Prof. Mihai DARABAN, Ph.D – mihai.daraban@ael.utcluj.ro						
2.5 Year of study	III	2.6 Semester	2	2.7 Assessment	E	2.8 Subject category	DS/DFac

3. Estimated total time

3.1 Number of hours per week	4	of which: 3.2 course	2	3.3 seminar / laboratory	2
3.4 To Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar / laboratory	28

Distribution of time	hours
Manual, lecture material and notes, bibliography	20
Supplementary study in the library, online specialized platforms and in the field	4
Preparation for seminars / laboratories, homework, reports, portfolios and essays	16
Tutoring	2
Exams and tests	2
Other activities:	-

3.7 Total hours of individual study	44
3.8 Total hours per semester	100
3.9 Number of credit points	4

4. Pre-requisites (where appropriate)

4.1 curriculum	Electronic Devices, Electrical Circuits Theory, Signals Theory, Digital Integrated Circuits, Computer Aided Design
4.2 competence	

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	N/A
Transversal competences	N/A

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

7.1 General objective	Learning the steps and practices to improve the design, modelling and simulation of a printed circuit board (PCB)
7.2 Specific objectives	1. Learning the steps for modelling electromagnetic disturbances using simulation environment. 2. Learning practical techniques for designing electronic schematics and printed circuit boards (PCB).

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Introductive lecture. Standardization.	Oral presentation, discussions, solved exercises, case study	Power-Point slides, Video-projector presentation
2. Design for Thermal Compatibility I		
3. Design for Thermal Compatibility II		
4. Design for Compatibility with Technology		
5. Design for Electromagnetic Compatibility I		
6. Design for Electromagnetic Compatibility II		
7. Design for Electromagnetic Compatibility III		
8. Design for Signal Integrity I		
9. Design for Signal Integrity II		
10. Design for Signal Integrity III		
11. Design for Power Supply Integrity I		
12. Design for Power Supply Integrity II		
13. Non-disturbances design for PCBs I		
14. Non-disturbances design for PCBs II		

Bibliography

1. M. Daraban, D. Pitica – Elemente de Proiectare pentru Compatibilitate Electromagnetica si Integritate a Semnalelor – Note de curs si aplicatii, Ed. U.T.PRESS, Cluj-Napoca, 2018
2. Pitica D. - Proiectare antiperturbativă în sisteme electronice, Ed. Albastră, Cluj-Napoca, 2000;
3. Eric Bogatin, Signal Integrity - Simplified. New York, United States: Prentice Hall, 2008;
4. P.R. Clayton - Introduction to Electromagnetic Compatibility, New Jersey: John Wiley & Sons, 2006;
5. Schwab A.J. - Compatibilitatea electromagnetică, Editura Tehnică, Bucureşti, 1996;
6. Tummala R. – Fundamentals of Microsystems Packaging, McGraw-Hill, 2001.

8.2 Seminar / laboratory / project	Teaching methods	Notes
1. PCBs fabrication technologies presentation. Project description.	Didactic and experimental proof,	Use of laboratory instrumentation,

2. General presentation of program OrCAD 9.x. Creation of a project with PCB finality, files names and extensions, significations.	case study, teamwork	experimental boards, laboratory computers, white/magnetic board
3. Using CAPTURE window, hierarchical blocks. Electrical schematic editing.		
4. Libraries, components and symbols creation.		
5. Electrical schematic processing, report files generation.		
6. Generation and correcting the NETLIST file, footprints creating and modifying.		
7. Intermediary examination for small project.		
8. LAYOUT Program: steps to initialize a PCB project.		
9. Steps for setting a PCB.		
10. Footprint placement on PCB, routing rules.		
11. Smart Route program presentation, PCB's geometry optimization.		
12. Post processing and report files generation (files for fabrication process).		
13. Small project examination.		
14. Discipline examination		

Bibliography

1. M. Daraban, D. Pitica – Elemente de Proiectare pentru Compatibilitate Electromagnetica si Integritate a Semnalelor – Note de curs si aplicatii, Ed. U.T.PRESS, Cluj-Napoca, 2018
2. Pitica D. - Proiectare antiperturbativă în sisteme electronice, Ed. Albastră, Cluj-Napoca, 2000;
3. Eric Bogatin, Signal Integrity - Simplified. New York, United States: Prentice Hall, 2008;
4. Kraig Mitzner – Complte PCB Design Using orCAD capture and PCB Editor, Elsevier Science, 2009

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 organizations and the employers in the field, where the students carry out the internship stages and/or occupy a job (in the field of research and electric circuit design, schematic integrator, printed circuit board design (layout)), 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	Written exam, 3 h	E – 60%
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Oral presentation of a small project – 1 h	L – 40%
10.6 Minimum standard of performance			
Quality Level: Minimum knowledge: ✓ Knowledge of the main thermal phenomena that affect the functioning of electrical circuits.			

- ✓ Knowledge of the main anti-disturbance techniques for preventing inductive and capacitive coupling.
- ✓ Knowledge of the phenomena underlying the propagation of electrical signals on transmission lines.
- ✓ Knowledge of techniques for creating controlled impedance trances on printed circuit boards (PCBs).

Minimum competences:

- ✓ Can describe the main thermal phenomena that can lead to thermal run away of an electric device mounted on a printed circuit board (PCB).
- ✓ Can describe the main techniques used to prevent inductive and capacitive coupling between the tracks/modules of a printed circuit board (PCB).
- ✓ Can characterize the reflection and crosstalk phenomena that are occurring on transmission lines of a printed circuit board (PCB).
- ✓ Can exemplify how to design a controlled impedance trace (microstrip or stripline) on a printed circuit board (PCB).

Quantitative level:

- ✓ Attend to all laboratory sessions
- ✓ The written exam and laboratory project marks must be greater or equal to 5.
- ✓ The mark will be computed using the following equation: 0.6*Exam_mark + 0.4*Laboratory_mark

Date of filling in:	**Responsible**	**Title Surname NAME**	**Signature**
29.09.2020	Course	Assist. Prof. Mihai DARABAN, Ph.D	
	Applications	Assist. Prof. Mihai DARABAN, Ph.D	

Date of approval in the Department of Communications 30.09.2020	Head of Communications Department Prof. Virgil DOBROTA, Ph.D.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 30.09.2020	Dean Prof. Gabriel OLTEAN, Ph.D.