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	38.00

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. Raul Fizeșan, PhD Eng. – raul.fizesan@ael.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assist. Prof. Raul Fizeșan, PhD Eng.– raul.fizesan@ael.utcluj.ro						
2.5 Year of study	III	2.6 Semester	2	2.7 Assessment	E	2.8 Subject category	DS/DI

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	15
Tutoring	2
Exams and tests	3
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	C4 - Design and use of low complexity hardware and software applications specific to the applied electronics • C4.3 Identification and optimization of hardware and software solutions of problems related to: industrial electronics, medical electronics, automotive electronics, automation, robotics, production of consumer goods • C4.4 Use of appropriate performance criteria for the evaluation, including by simulation, of hardware and software of dedicated systems or service activities in which microcontrollers or computing systems of reduced or medium complexity are used C6 - Solving technological issues in the fields of applied electronics • C6.1 Defining the principles and methods underlying the manufacture, adjustment, testing and troubleshooting of the appliances and equipment in the fields of applied electronics • C6.5 Designing the manufacturing and maintenance technology (specifying the necessary components and operations) of low and medium complexity products from the fields of applied electronics
Cross competences	CT1 Methodical analysis of the issues encountered in the activity field, identifying the elements for which there are established solutions, thus ensuring the completion of professional tasks

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. Design a PCB	Oral presentation, discussions, solved exercises, case study	Power-Point slides, Video-projector presentation
2. Properties of a PCB		
3. Design for Electromagnetic Compatibility I		

4. Design for Electromagnetic Compatibility II		
5. Design for Electromagnetic Compatibility III		
6. Design for Electromagnetic Compatibility IV		
7. Design for Signal Integrity I		
8. Design for Signal Integrity II		
9. Design for Signal Integrity III		
10. Design for Power Integrity		
11. Design for Thermal Compatibility I		
12. Design for Thermal Compatibility 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, case study, teamwork	Use of laboratory instrumentation, experimental boards, laboratory computers, white/magnetic board
2. Creation of a project with PCB finality, files names and extensions, significations.		
3. 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. Steps to initialize a PCB project.		
9. Steps for setting a PCB.		
10. Footprint placement on PCB, routing rules.		
11. 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: 40 questions with multiple answers.	Written exam, 3 h	E – 50%
10.5 Seminar/ Laboratory	The level of acquired knowledge and abilities	Oral presentation of a small project – 0.3 h	L – 50%
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
20.06.2024	Course	Assist. Prof. Raul FIZEȘAN, PhD Eng.	
	Applications	Assist. Prof. Raul FIZEȘAN, PhD Eng.	

Date of approval in the Department of Applied Electronics 28.06.2024	Head of Department Prof. Dorin PETREUS, PhD Eng.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 11.07.2024	Dean Prof. Ovidiu Aurel POP, PhD Eng.