

## 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 | Applied Electronics  |
| 1.7 Form of education              | IF-Full time   |
| 1.8 Subject code                   | 46.00  |

### 2. Data about the subject

|  |  |              |   |                |   |                      |       |
|--|--|--------------|---|----------------|---|----------------------|-------|
| 2.1 Subject name                       | Power Supplies   |              |   |                |   |                      |       |
| 2.2 Subject area                       | Theoretical area   |              |   |                |   |                      |       |
|  | Methodological area  |              |   |                |   |                      |       |
|  | Analysis area  |              |   |                |   |                      |       |
| 2.3 Course responsible                 | Prof. Dorin Petreus, PhD Eng.– <a href="mailto:dorin.petreus@ael.utcluj.ro">dorin.petreus@ael.utcluj.ro</a>                  |              |   |                |   |                      |       |
| 2.4 Teachers in charge of applications | Assist. Prof. Radu Etz, PhD Eng. - <a href="mailto:radu.etz@ael.utcluj.ro">radu.etz@ael.utcluj.ro</a>                        |              |   |                |   |                      |       |
|  | Assist. Prof. Toma Patarau, PhD Eng.– <a href="mailto:toma.patarau@ael.utcluj.ro">toma.patarau@ael.utcluj.ro</a>             |              |   |                |   |                      |       |
|  | Eng. Andreea Ignat, PhD Stud. - <a href="mailto:Andreea.Ignat@ael.utcluj.ro">Andreea.Ignat@ael.utcluj.ro</a>                 |              |   |                |   |                      |       |
|  | Teaching Assist. Eniko Szilagyi (Lazar), PhD Eng. - <a href="mailto:Eniko.Lazar@ael.utcluj.ro">Eniko.Lazar@ael.utcluj.ro</a> |              |   |                |   |                      |       |
| 2.5 Year of study                      | IV   | 2.6 Semester | 1 | 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 applications | 2     |
| 3.4 Total hours in the curriculum  | 56  | of which, 3.5 course | 28 | 3.6 applications | 28    |
| Individual study   |     |                      |    |                  | Hours |
| Manual, lecture material and notes, bibliography                                 |     |                      |    |                  | 30    |
| Supplementary study in the library, online and in the field                      |     |                      |    |                  | 5     |
| Preparation for seminars/laboratory works, homework, reports, portfolios, essays |     |                      |    |                  | 30    |
| Tutoring   |     |                      |    |                  | 2     |
| Exams and tests  |     |                      |    |                  | 2     |
| Other activities.....  |     |                      |    |                  |       |
| 3.7 Total hours of individual study  | 69  |                      |    |                  |       |
| 3.8 Total hours per semester   | 125 |                      |    |                  |       |
| 3.9 Number of credit points  | 5   |                      |    |                  |       |

### 4. Pre-requisites (where appropriate)

|                |  |
|----------------|--|
| 4.1 Curriculum | -  |
| 4.2 Competence | Knowledge of electronics, system control and magnetic theory |

## 5. Requirements (where appropriate)

|                           |                           |
|---------------------------|---------------------------|
| 5.1. For the course       | Amphitheatre, Cluj-Napoca |
| 5.2. For the applications | Laboratory, Cluj-Napoca   |

## 6. Specific competences

|                     |   |
|---------------------|---|
| Professional skills | <p>C4. To design and use low complexity hardware and software applications, specific to applied electronics</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• 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</li> </ul> <p>C5. Application of the basic knowledge, concepts and methods from: power electronics, automatic systems, electricity management, electromagnetic compatibility</p> <ul style="list-style-type: none"> <li>• C5.1 Defining the specific elements that individualize the electronic devices and circuits in the fields of: power electronics, automated systems, electricity management, medical electronics, automotive electronics, consumer goods</li> <li>• C5.2 Qualitative and quantitative interpretation of the functioning of circuits in the fields of: power electronics, automatic systems, electricity management, medical electronics, automotive electronics, consumer goods; operation regarding electromagnetic compatibility</li> <li>• C5.5 Designing, using established principles and methods of subsystems of reduced complexity, from the fields of applied electronics: power electronics, automated systems, electricity management, medical electronics, auto electronics, consumer goods</li> </ul> <p>C6. To solve technological problems, specific to applied electronics</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• 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</li> </ul> |
| Cross competences   | N.A.  |

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

|                        |   |
|------------------------|---|
| 7.1 General objectives | Development of professional skills in the field of design, simulation and testing of electronic power circuits. |
|------------------------|---|

|                         |   |
|-------------------------|---|
| 7.2 Specific objectives | <ol style="list-style-type: none"> <li>1. The assimilation of theoretical knowledge regarding design and simulation of electronic circuits using advanced simulation programs;</li> <li>2. Obtaining the skills and abilities necessary for implementation and testing of the performance of power electronic circuits.</li> <li>3. Obtaining the skills to use specific equipment for electronic power converters</li> </ol> |
|-------------------------|---|

## 8. Contents

| 8.1 Lecture (syllabus)  | Teaching methods   | Notes   |
|---|--|---|
| 1. Introduction to power supplies.  | Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation | Use of .ppt presentation, projector, blackboard   |
| 2. Rectifiers   |  |   |
| 3. Linear regulators  |  |   |
| 4. Linear regulators using integrated circuits  |  |   |
| 5. The step-down DC-DC converter. Buck converter  |  |   |
| 6. The inverting DC-DC converter. Buck-boost converter  |  |   |
| 7. The step-up DC-DC converter. Boost converter   |  |   |
| 8. Flyback converter  |  |   |
| 9. Forward converter  |  |   |
| 10. Push-pull converter   |  |   |
| 11. Half-bridge converter   |  |   |
| 12. Control of power supplies   |  |   |
| 13. Magnetic components design  |  |   |
| 14. Noise and electromagnetic compatibility in power supplies   |  |   |
| References  |  |   |
| 1. Dorin Petreuş - Electronica surselor de alimentare-Editura Mediamira, Cluj-Napoca, 2002  |  |   |
| 8.2 Applications  | Teaching methods   | Notes   |
| 1. Laboratory description. Laboratory protection measures.  | Didactic and experimental proof, didactic exercise, team work  | Use of laboratory instrumentation, experimental boards, computers, white/magnetic board |
| 2. Rectifiers   |  |   |
| 3. Linear regulators  |  |   |
| 4. Linear regulators using integrated circuits  |  |   |
| 5. The step-down DC-DC converter. Buck converter  |  |   |
| 6. The inverting DC-DC converter. Buck-boost converter  |  |   |
| 7. The step-up DC-DC converter. Boost converter   |  |   |
| 8. Flyback converter  |  |   |
| 9. Forward converter  |  |   |
| 10. Push-pull converter   |  |   |
| 11. Half-bridge converter   |  |   |
| 12. Self-oscillating flyback converter  |  |   |
| 13. Self-oscillating flyback converter with current transformer   |  |   |
| 14. Self-oscillating push-pull converter  |  |   |
| References  |  |   |
| Bibliografie  |  |   |
| 1. D. Petreuş, Ş.Lungu - Surse în comutație – îndrumător de laborator, Ed. Mediamira, Cluj-Napoca, 1999.                                      |  |   |
| 2. Dorin Petreuş, Toma Patarau, Radu Etz - Power supplies – A practical approach, Mediamira, Cluj-Napoca, 2016, ISBN: 978-973-713-333-5       |  |   |
| 3. Power supplies – a practical approach, Dorin Petreus, Toma Patarau, Radu Etz, editura Mediamira Cluj-Napoca, 2016, ISBN: 978-973-713-333-5 |  |   |

**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 applied electronics), and the expectations of the national organization for quality assurance (ARACIS).

**10. Evaluations**

| Activity type   | 10.1 Assessment criteria   | 10.2 Assessment methods              | 10.3 Weight in the final grade |
|---|--|--------------------------------------|--------------------------------|
| 10.4 Course   | Solving a problem and answering a set of theoretical questions                     | Written exam                         | 60%                            |
| 10.5 Applications   | Verification of skills and abilities acquired as a result of laboratory activities | Oral examination during the semester | 40%                            |
| 10.6 Minimum standard of performance  |  |                                      |                                |
| <p><b>Qualitative level:</b></p> <p>Minimal knowledge:</p> <ul style="list-style-type: none"> <li>✓ Knowledge of the basic operation of the circuits studied</li> <li>✓ Knowledge of the basic operation of studied power converters</li> </ul> <p>Minimal competences:</p> <ul style="list-style-type: none"> <li>✓ To be able to describe the functionality of the main power converters</li> <li>✓ To be able to choose the proper power converters in specific applications</li> </ul> <p><b>Quantitative level:</b></p> <ul style="list-style-type: none"> <li>✓ Participation to all applications and laboratories</li> <li>✓ The final exam and laboratory grades to be higher than 5</li> <li>✓ The final grade is calculated as follows: <math>0.6 * \text{Exam grade} + 0.4 * \text{laboratory grade}</math></li> </ul> |  |                                      |                                |

| Date of filling in | Responsible  | Title, Name Surname                  | Signature |
|--------------------|--------------|--------------------------------------|-----------|
| 23.06.2023         | Course       | Prof. Dorin Petreus, PhD Eng.        |           |
|                    | Applications | Assist. Prof. Toma Patarau, PhD Eng  |           |
|                    |              | Assist. Prof. Toma Patarau, PhD Eng. |           |
|                    |              | Teaching Assist. Drd.Mirela Olteanu  |           |
|                    |              |                                      |           |
|                    |              |                                      |           |
|                    |              |                                      |           |

Date of approval in the Department of Applied Electronics

30.06.2023

Head of department

Prof. Dorin PETREUȘ, PhD Eng.

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

12.07.2023

Dean

Prof. Ovidiu Aurel POP, PhD Eng.