Syllabus

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Automation and Computer Science
1.3 Departament	Automation
1.4 Field of study	Systems Engineering
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Automation and Applied Informatics (English)
1.7 Form of education	Full time

2. Data about the subject

2.1 Subject name	***Power Electronics***				Discipline code	**35.10**
2.2 Course responsible/lecturer	Prof.dr.ing Festila Clement – clement.festila@aut.utcluj.ro					
2.3 Teachers in charge of applications	Dr.ing. Neaga Olimpiu Adrian – adrian.neaga@aut.utcluj.ro					
2.4 Year of study	3	2.5 Semester	1	2.6 Assessment *(E/C/V)*		E
2.7 Type of subject	*DF – fundamental, DS – specialty, DC – complementary*					DS
	DOB – compulsory, DOP – elective, DFA – optional					DOP

3. Estimated total time

3.1 Number of hours per week	4	of which:	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	1	3.3 Project	1
3.4 Number of hours per semester	56	of which:	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	14	3.6 Project	14
3.7 Individual study										
(a) Manual, lecture material and notes, bibliography										28
(b) Supplementary study in the library, online and in the field										10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										28
(d) Tutoring										
(e) Exams and tests										3
(f) Other activities:										28

3.8 Total hours of individual study (sum of (3.3(a)...3.3(f)))	69
3.9 Total hours per semester (3.2+3.4)	125
3.10 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 Curriculum	System Theory, Electronic devices and Circuits
4.2 Competence	control principles torque / speed for DC and AC motors, control principles torque / speed for special electric motors, electrical circuits supply problem

5. Requirements (where appropriate)

5.1. For the course	N/A
5.2. For the applications	Attendance is mandatory

6. Specific competences

Professional competences	C1. Applying knowledge of mathematics, physics, measurement techniques, technical drawing, mechanical, chemical, electrical, and electronic engineering in systems engineering. C4. Designing, implementing, testing, operating, and maintaining systems using general-purpose and specialized equipment, including computer networks, for automation and applied computer science applications
Cross competences	CT2. Identifying roles and responsibilities within a multidisciplinary team, making decisions, and assigning tasks, while applying interpersonal skills and techniques for effective teamwork. CT3. Identifying opportunities for continuing education and effectively utilizing learning resources and techniques for one's own professional development.

7. Expected learning outcomes

Knowledge	The student/graduate describes, identifies, and summarizes concepts and methods related to systems in general, such as electrical and electronic engineering, and how they are applied to specific problems, using specific mathematical and physical tools; designs, implements, tests, and uses systems with general-purpose and specialized equipment, and understands how to maintain them
Skills	The student/graduate designs and implements control systems for industrial processes, robots, and flexible production lines, including through modern approaches based on the Internet of Things and Industry 4.0; selects equipment and commissions the related systems; and applies the principles of mathematics and physics to solve problems using measurement and analysis techniques;
Responsibilities and autonomy	The student/graduate is committed to lifelong learning in order to acquire and apply knowledge as needed, using appropriate learning strategies; promotes dialogue, cooperation, respect for others, and intercultural understanding; works effectively as a team member or team leader; behaves honorably, responsibly, and ethically, in accordance with the law, to uphold the profession's reputation; contributes constructively to multidisciplinary teams, taking on various roles and clearly communicating engineering concepts, progress, and results to both technical and non-technical audiences; takes responsibility for the quality, safety, and ethical implications of engineering work, taking into account social, legal, and environmental impacts; monitors personal progress in learning, seeks feedback, and adopts strategies for continuous professional and personal development; plans, executes, and manages tasks independently, from problem definition to solution, demonstrating initiative in adopting new tools, methods, and technologies.

8. Course objectives

General objective	Integration of the electronic equipment in a complex control loop
Specific objectives	Knowing the structure, characteristic and function of specific circuits Modelling of power electronic circuits

9. Contents

9.1 Lecture	No.hours	Teaching methods	Notes
The specific of power electronics	2	Teaching using laptop and projector, interactive course, debate	
Power electronics circuits used in automatic control closed loop	2		
Switching analysis of bipolar transistor	2		
Switching analysis of the MOSFET transistor	2		
Switching analysis of the thyristors and GTO devices	2		
Switching analysis of Triacs	2		
Switching analysis of IGBT transistor	2		
Switching analysis of MCT thyristors	2		
The structure, operating principles and design of solid state relays	2		
AC Voltage Controllers used as actuators in control systems	2		
DC Voltage Controllers: usage as actuator or regulated power supply	2		
Controlled rectifiers used as actuators in control systems	2		
Inverters used as actuators in control systems	2		
Case studies	2		

Bibliography

1. Festila, Cl. ş.a. – Power Electronics in Automation Control, Editura Mediamira, Cluj-Napoca, 2000.
2.WILLIAMS B.W., Power electronics : devices, drivers, applications and passive components, London, 1992
3.Mohan, N. ş..a. – Power Electronics, John Wiley, 1995
4.BOSE Bimal K., Modern power electronics and AC Drives, Upper Saddle River, New Jersey, 2001
5.TRZYNADLOWSKI Andrzej M., Introduction to modern power electronics, New York, 1998

9.2 Aplications (seminar/laboratory/project/practical work)	No.hours	Teaching methods	Notes
L1. Work protection notions and laboratory presentation. Analysis of the bipolar transistor switching	2	Presentation of examples, demonstrations, discussions, practical applications	Mandatory attendance
L2. Analysis of power amplifiers in switching mode of operation	2		
L3. Integrated circuits for thyristors and triacs control	2		
L4. The analysis of solid state relays	2		
L5. The analysis of controlled rectifiers	2		
L6. The analysis of DC and AC voltage controllers	2		

L7. The analysis of J-15 Hittachi inverter for the control of asynchronous motor	2		
Project			
P1. Design and analysis of a line transformer	2		
P2. Design and analysis of rectifier circuits	2		
P3. Design of the smoothing filter	2		
P4. Design of step-down power supply	2		
P5. Design of bipolar thyristor rectifier	2		
P6. Design of step-up power supply	2		
P7. Project presentation and Conclusions	2		

Bibliography
1. Festila, Cl. ş.a. – Power Electronics in Automation Control, Editura Mediamira, Cluj-Napoca, 2000.
2. WILLIAMS B.W., Power electronics: devices, drivers, applications and passive components, London, 1992
3. Mohan, N. ş..a. – Power Electronics, John Wiley, 1995
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10. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Course content was discussed with representatives of prestigious companies in the field in Romania, Europe and USA and rated several times by government agencies in Romania (CNEAA , ARACIS)

11. Evaluation

Activity type	11.1 Assessment criteria	1.2 Assessment methods	11.3 Weight in the final grade
11.4 Course	Assessment of knowledge through a test based on the knowledge gained following participation in the course	Written exam	60%
11.5 seminar/ laboratory/ project/ practical work	Examination of the skills and knowledge acquired through participation in the laboratory. Project presentation	Practical assessment Practical presentation	20% 20%
11.6 Minimum performance standard N=0.6E+0.2*L+0.2P, N≥5, E≥5, L≥5, P≥5			

Date of filling in:		Title Firstname NAME	Signature
	Course	Prof.dr.ing Festila Clement	
	Aplications	Dr.ing. Neaga Olimpiu Adrian	

Date of approval by the Department Board

Head of Departament
Prof.dr.ing. Honoriu VĂLEAN

Date of approval by the Faculty Council

Dean
Prof.dr.ing. Vlad MUREȘAN