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	Applied Electronics
1.7 Form of education	Full time
1.8 Subject code	40.00

2. Data about the subject

2.1 Subject name	Command and Control Elements						
2.2 Subject area	Theoretical area Methodological area Analytic area						
2.3 Course responsible	Assist. Prof. Ionuţ CIOCAN, PhD Eng. ionut.ciocan@ael.utcluj.ro						
2.4 Teacher in charge with seminar / laboratory / project	Assist. Prof. Ionuţ CIOCAN, PhD Eng. ionut.ciocan@ael.utcluj.ro						
2.5 Year of study	III	2.6 Semester	2	2.7 Assessment	V	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	5
Supplementary study in the library, online specialized platforms and in the field	4
Preparation for seminars / laboratories, homework, reports, portfolios and essays	5
Tutoring	2
Exams and tests	3
Other activities:	-

3.7 Total hours of individual study	19
3.8 Total hours per semester	75
3.9 Number of credit points	3

4. Pre-requisites (where appropriate)

4.1 curriculum	Special Mathematics, Signals Theory, Analysis and Synthesis of Circuits
4.2 competence	Knowledge of basics electronics

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. To design and use low complexity hardware and software applications, specific to 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 C5. To apply knowledge, concepts and basic methods from power electronics, automated systems, electric energy management, electromagnetic compatibility • 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 • 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 • 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 C6. To solve technological problems, specific to 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	N.A.

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

7.1 General objective	Developing the competences regarding the design, simulating and testing of the automatic control systems.
7.2 Specific objectives	1. Assimilation of theoretical knowledge for the design and simulation of automatic systems using advanced simulation tools 2. Obtaining the needed skills and abilities to implement and test the performance of the automatic control systems.

8. Contents

8.1 Lecture (syllabus)	Teaching methods	Notes
1. Standard structure of a automatic control systems. Classifying automatic control systems. Examples of automatic control systems.	Presentation, heuristic conversation, exemplification, problem presentation, teaching exercise, case study, formative evaluation	Use of .ppt presentation, projector, blackboard
2. Modeling automatic control systems. Input-output models. Differential equations, transfer functions and frequency characteristics.		
3. Input-state-output models. State equations, choosing state variables, calculating the response of a system modeled by state equations, calculating the transfer function. The automatic control task.		
4. The configuration of a numerical control loop, sampling and restoring signals, transfer functions of a numerical control loop, the calculation of the response of a numerical control loop. State equations for discrete systems, response calculation, determining the transfer function.		
5. Steady-state error in stabilization and tracking systems, transient regime performance (overshoot, response time, etc.). Dynamic performances calculation for second order systems.		
6. Using transfer function in appreciating performances. Calculation of step response, bandwidth calculation. The effect of introducing a zero or a pole in the transfer function of a second order system. The effect of introducing a zero-pole in the transfer function of a second degree system.		
7. Lead-lag element. The relationship between the complex-conjugated poles position and step response. The connection between plane “z” and “s”. The stability of numeric control systems.		
8. Proportional algorithms (P), proportional-integral algorithms(PI), proportional-derivative algorithms(PD).		
9. Proportional-integral-derivative algorithms (PID). Modified PID algorithms.		
10. Filtering algorithms “first order element type”. Filtering algorithms with constant bandwidth. Filtering algorithms with variable bandwidth.		
11. Typified algorithms. Lead-Lag algorithm. Position PID algorithms. Speed PID algorithms. Modified PID algorithms.		
12. Non-typified algorithms. Dead-Beat algorithms. Kalman algorithms. Dahlin algorithms.		
13. Dead time systems, defining dead time, the effect of dead time over the performance of automatic control systems, methods of compensating the effects of dead time, first order prediction control algorithms.		
14. Second order prediction control algorithms. Recapitulation and preparing subjects for the exam.		
Bibliography 1. Niculaie Palaghiţă, Dorin Petreuş, Cristian Fărcaş, „Electronică de Comandă şi Reglaj”, Ed. Mediamira, Cluj-Napoca, 2006, 360 pagini, ISBN 973-713-109-6		
8.2 Seminar	Teaching methods	Notes

1. Differential equations, transfer functions in first and second order systems	Presentation, demonstration, didactic exercise.	Presentation, demonstration, didactic exercise.
2. Bode plots. Frequency analysis		
3. State space equations used to model a DC motor		
4. System response performance analysis of a DC-DC step down converter		
5. Comparison between the response performances of an analog and digital controller		
6. Closing two loops to control a DC motor speed.		
7. Override technique		
8.3. Laboratory	Teaching methods	Notes
1. Laboratory description. Labour protection measures. MATLAB using in automatic control systems.	Didactic and experimental proof, didactic exercise, team work.	Use of simulating tools, computers, white board, experimental boards
2. SIMULINK using in automatic control systems.		
3. Adaptive gain buck converter analysis.		
4. System responses at different regulation parameters of the controller.		
5. Dead-time systems. Prediction control.		
6. Velocity control system for a brushed DC motor with permanent magnets.		
7. Humidity and temperature control system.		

Bibliography

1. Niculaie Palaghiţă, Dorin Petreuş, Cristian Fărcaş, „Electronică de Comandă şi Reglaj”, Ed. Mediamira, Cluj-Napoca, 2006, 360 pagini, ISBN 973-713-109-6
2. Petreuş D., Muntean G., Juhos Z., Palaghiţă N., „Aplicaţii cu microcontrolere din familia 8051”, Ed. Mediamira, Cluj-Napoca, 2005, 164 pagini, ISBN 973-713-014-6
3. Niculaie Palaghiţă, Dorin Petreuş, Cristian Fărcaş, „Electronică de putere, partea a II-a, Circuite electronice de putere”, Editura Mediamira, 2004, 310 pag., ISBN 973-713-039-1
4. Vlaicu Aurel, N. Palaghiţă s.a., „Clădiri inteligente - Sisteme, Tehnologii, Soluţii Integrate IT&C”, Ed. UT PRESS, Cluj-Napoca, 2008, 416 pag., ISBN 978-973-662-397-4
5. Gene F. Franklin, J. David Powell, Abbas Emami-Naeini, "Feedback control of dynamic systems", Pearson, 2010, 819 pag, ISBN 978-0-13-500150-9.

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 automatic control systems), 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	Two issues of theory from the first and, respectively, the second part of the subjects taught	Oral examination	60%

10.5 Seminar/ Laboratory	Solving a problem specific to the power electronic circuits	Oral examination	20%
	Two written and one oral tests for evaluating the knowledge and practical skills and abilities acquired	Ongoing evaluation	20%
10.6 Minimum standard of performance			
Qualitative level Minimum knowledges: ✓ knowing the principles of automatic control systems adjustment ✓ Knowing the main types of algorithms used in automatic control systems ✓ Answering correctly at least one subject of theory, exposing issues of theory and applications in a technical appropriate speech Minimum competences: ✓ To implement and test the performance of the automatic control systems **Quantitative level** ✓ Performing all laboratory works ✓ Obtaining a minimum mark of 5 at the laboratory evaluation.			

Date of filling in:	**Responsible**	**Title Surname NAME**	**Signature**
10.06.2025	Course	Assist. Prof. Ionuţ CIOCAN, PhD Eng.	
	Applications	Assist. Prof. Ionuţ CIOCAN, PhD Eng.	

Date of approval in the Department of Applied Electronics 18.06.2025	Head of Department Prof. Dorin PETREUȘ, PhD Eng.
Date of approval in the Council of Faculty of Electronics, Telecommunications and Information Technology 25.06.2025	Dean Prof. Ovidiu Aurel POP, PhD Eng.