SYLLABUS

1. Program Information

1.1 Higher education institution	Technical University of Cluj-Napoca
1.2 Faculty	Faculty of Automation and Computer Science
1.3 Department	Department of Automation
1.4 Field of study	Automation, Applied Informatics and Intelligent Systems
1.5 Cycle of studies	Bachelor
1.6 Study Programme/Qualification	Intelligent Automation Systems (dual, in English language)
1.7 Form of education	IF – full-time education
1.8 Course code	32.00

2. Course information

2.1 Course title				**Control Engineering 1**		
2.2 Course lecturer				*Prof. Dr. Eng. DULF Eva-H.– eva.dulf@aut.utcluj.ro*		
2.3 Seminar / Laboratory / Project Lecturer				*Prof. Dr. Eng. DULF Eva-H.– eva.dulf@aut.utcluj.ro*		
2.4 Year of study	3	2.5 Semester	1	2.6 Type of assessment		E
2.7 Course status	Formative category *(DF, DS, DC)*					DD
	Optionality *(DI, DO, DFac)*					DI

3.Total estimated time

3.1 Number of hours per week	4	of which:	HEI	Lecture	2	Seminar		Laboratory	2	Project	
			CO		0		0				
3.2 Number of hours per semester	56	of which:	HEI	Lecture	28	Seminar		Laboratory	28	Project	
			CO		0		0				

3.3 Distribution of time allocation (hours per semester) for:	HEI	CO
(a) Study based on textbook, course support, bibliography, and notes	28	
(b) Additional documentation in library, specialized electronic platforms, and fieldwork	10	
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	28	
(d) Tutoring	0	
(e) Examinations	3	
(f) Other activities:	0	
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	69	
3.5 Total hours per semester (3.3+3.4)	125	
3.6 Number of credits per semester	5	

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	• Process Modelling, Introduction to System Theory and Control Systems.
4.2 Competency Prerequisites	• Knowledge's gained after attending Mathematic general courses, Theoretical Basis for Automatic Systems , System Identification

5. Conditions (where applicable)

5.1. Course Organization Conditions	• Prior reading of the course slides.
5.2. Seminar / Laboratory / Project organization conditions	• Prior preparation of laboratory work.

6. Specific Competencies Acquired

Professional Competencies	• PC02 Analyse test data • PC05 Conduct quality control analysis • PC08 Design automation components • PC12 Gather technical information • PC26 Use information technology tools • PC27 Execute analytical mathematical calculations • PC30 Design control systems • PC32 Perform data analysis
Transversal Competencies	• TC01 Apply knowledge of science, technology and engineering • TC02 Think analitically • TC05 Interpret mathematical information

7. Learning outcomes

Knowledge:	• The student/graduate describes, identifies, and summarises fundamental concepts from automatic control systems and their application to concrete problems.
Skills:	• The student/graduate utilises programming languages, environments, technologies, and specific tools (algorithms, diagrams, models) to solve well-defined problems with applicability in the field of automatic process control.
Responsibility and autonomy:	• The student/graduates displays honorable, responsible, and ethical behavior, in accordance with the law, to uphold the reputation of the profession.

8. Course Objectives

8.1 General objective of the course	• Providing the graduates with sound engineering knowledge and broad professional skills to design, develop, implement, manage and supervise automation systems.
8.2 Specific objectives	Understanding and successfully applying automation fundamentals and computer-aided design techniques: • Identifying the concepts of automatic control engineering • Explaining and interpreting problems of automation of types of processes by applying the fundamentals of automation • Solving some types of automated control problems • Evaluating the performance of automated systems • Configuring and implementing process control systems

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
Performance specifications of control system design	2	Lectures, systematic exposition, conversation, teaching demonstration, case study	In case of major force classes will be held online
Controller design using root locus method. The problem of correction	2		
Frequency design methods based on second order equivalent system for PI, PD	2		
Frequency design methods based on second order equivalent system for PID controllers	2		

Quasi-optimum methods (Kessler's magnitude and symmetry)	2		using Teams.
Frequency methods with imposed phase margin	2		
Theoretical Basis for experimental tuning methods (Offereins, Oppelt, Ziegler-Nichols)	2		
Controller design for dead time processes	2		
Conventional and non-conventional structures. Cascade and feed – forward loop control design	2		
Decentralized control of MIMO systems	2		
Decoupled control of MIMO systems	2		
Preliminaries on adaptive control methods	2		
Preliminaries on predictive control methods	2		
Case studies	2		

Bibliography

1. Nise, N.S., Control systems engineering, John Wiley and Sons, 2019;
2. Brunton S.L., Kutz J.N., Data-driven science and engineering : machine learning, dynamical systems, and control, Cambridge University Press, 2022;
3. Schuppen, J.H., Control and system theory of discrete-time stochastic systems, Springer Nature, 2021.

9.2 Seminar / laboratory / project	Hours HEI	Hours CO	Teaching methods	Obs.
Steady –state error interpretation for control systems	2		Brainstorming, case study, conversation.	In case of major force classes will be held online using Teams.
Performance measures of control systems	2			
Root locus design method	2			
Correction for root locus design method	2			
Frequency design methods. P and PI controller	2			
Frequency design methods. PD and PID controller	2			
Quasi-optimum methods (Kessler's magnitude and symmetry)	2			
Frequency design methods with imposed phase margin	2			
Cascade loop control design	2			
Controller design using experimental design methods	2			
Controller implementation using PLC. Case studies	2			
Closed loop performance analysis according to PID parameter variation. Case study: ACS simulator	2			
Closed loop performance analysis according to PID parameter variation. Case study: speed and position control for a DC motor	2			
Closed loop performance analysis according to PID parameter variation. Case study: twin rotor aerodynamical system	2			

Bibliography

1. Nise, N.S., Control systems engineering, John Wiley and Sons, 2019;
2. Brunton S.L., Kutz J.N., Data-driven science and engineering : machine learning, dynamical systems, and control, Cambridge University Press, 2022;
3. Dulf E.H., Muresan C.I., Control Engineering 1, Laboratory guide – electronic version.

10. Correlation of course content with the expectations of the epistemic community representatives, professional associations, and major employers in the field related to the program

The content of this course is designed to align with the current and future needs of the industrial automation sector, ensuring that students are prepared to tackle real-world challenges in industrial systems.

11. Evaluation

Activity Type	Evaluation criteria	Evaluation methods	Weight in final grade
11.1 Lecture	Acquired knowledge Lecture activity	Written exam / online exam using Teams	60%
11.2 Seminar/ Laboratory/Project	Acquired practical skills, Laboratory activity	Practical assessment / online assessment using Teams	40%
11.3 Minimum Performance Standard			
Minimum standard of performance: Exam grade>5, Laboratory grade>5			

Date of completion:	Lecturers		Signature
16.06.2025	Course	Prof. Dr. Eng. Eva-H. DULF	
	Applications	Prof. Dr. Eng. Eva-H. DULF	

Date of approval by the Department of Automation Council 24.11.2025 _____	Director of the Department of Automation Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty of Automation and Computer Science Council 28.11.2025 _____	Dean Prof.dr.ing. Vlad MUREȘAN