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	43.00

2. Course information

2.1 Course title				**System Engineering I**	
2.2 Course lecturer				*Conf.Dr.Ing Clitan Iulia – iulia.clitan@aut.utcluj.ro*	
2.3 Seminar / Laboratory / Project Lecturer				*Conf.Dr.Ing Clitan Iulia – iulia.clitan@aut.utcluj.ro* *Dr.ing. Neaga Adrian (Emerson)* *Ing. Rosca Vlad (Emerson)*	
2.4 Year of study	3	2.5 Semester	2	2.6 Type of assessment	E
2.7 Course status	Formative category *(DF, DS, DC)*				DS
	Optionality *(DOB, DOP, DFac)*				DOB

3.Total estimated time

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

3.3 Distribution of time allocation (hours per semester) for:	HEI	CO
(a) Study based on textbook, course support, bibliography, and notes	14	
(b) Additional documentation in library, specialized electronic platforms, and fieldwork	4	
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays		18
(d) Tutoring	1	2
(e) Examinations	3	2
(f) Other activities:		
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	22	22
3.5 Total hours per semester (3.2+3.4)	50	50
3.6 Number of credits per semester	2	2

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	• Control Engineering, Introduction to System Theory and Control Systems, Physics, Chemistry, Power Electronics in Automation Control, System identification, Process modeling, Electric and Electronic Control Equipment
4.2 Competency Prerequisites	• Systems theory, sensors and transducers, process modeling, control engineering, control instrumentation

5. Conditions (where applicable)

5.1. Course Organization Conditions	• The student needs to be present at 70% of the total number of lectures in order to have the right to take the exam.

5.2. Seminar / Laboratory / Project organization conditions	• The attendance of laboratory is compulsory

6. Specific Competencies Acquired

Professional Competencies	• PC01 Adjust engineering designs • PC02 Analyse test data • PC06 Define technical requirements • PC08 Design automation components • PC12 Gather technical information • PC13 Interact professionally in research and professional environments • PC21 Report analysis results • PC26 Use information technology tools • PC30 Design control systems
Transversal Competencie	• TC01 Apply knowledge of science, technology and engineering • TC03 Demonstrate responsibility • TC04 Work in teams

7. Learning outcomes

Knowledge:	• The student/graduate describes, identifies and summarizes concepts of the fundamentals of automation, modeling methods, identification, simulation and analysis of industrial processes and computer-aided design techniques of classic and advanced automatic systems and their application in concrete problems.
Skills:	• The student/graduate interprets and explains automation problems of certain types of technological processes using basic principles of systems theory, automatic control engineering, modeling and simulation, computer-aided design techniques and analysis methods specific to systems engineering. • The student/graduate specifies requirements, develops simulation scenarios, proposes solutions to solve plant control problems.
Responsibility and autonomy:	• The student/graduate behaves honorably, responsibly, and ethically, in accordance with the law to ensure the reputation of the profession.

8. Course Objectives

8.1 General objective of the course	• Acquiring knowledge on basic principles and functional design solutions fot the main continuous plant control systems.
8.2 Specific objectives	• Acquiring knowledge about: analysis and synthesis of the automatic system, verifying the stability of the system, continuous control structures, PID controllers design, establish the main technological parameters and performances. • Acquiring abilities in control loops design and knowledge about transducers, actuators, analogical and numerical controllers.

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
C1 Introduction in Control Systems Structures, DCS	2	Slides presentation, explanations and demonstrations, discussions, case study,	
C2. Continuous and batch industrial systems. Standards	2		
C3 PID controller loops in industrial systems	2		
C4 Digital control systems. Main design methods review	2		
C5. Experimental indentification for output signals. Auto-tunning methods	2		
C6 Flow control structures	2		
C7 Level control structures	2		
C8 Pressure control structures	2		
C9 Temperature control structures	2		
C10 Advanced control structures: Master – Slave PID, cascade control, selective control	2		
C11 Advanced control structures: feedforward control, ratio control, split-range control, override control.	2		
C12 Control system design for chemical processes	2		
C13 Control system design for pharmaceutical processes	2		
C14 Control system design for power plants. Electrical and Unconventional heating systems	2		

Bibliography

1. Love Jonathan, Process Automation Handbook: A Guide to Theory and Practice, Springer Nature, ISBN 9781447168195, 2016.
2. Essentials of process control, William Luyben, McGraw-Hill, 1997.
3. Practical Process Control for Engineers and Technicians, Wolfgang Altmann, Elsevier, 2005
4. The control handbook, William Levine, CRC press, 1996,
5. Process Dynamicsand Control, D. Seborg et al. International Student Version, John Wiley 2011.
6. Conducerea proceselor industriale – Curs didactic, V. Mureşan, M. Abrudean, Editura Galaxia Gutenberg, Cluj-Napoca 2017, 181 pagini, ISBN 978-973-141-699-1.
7. Teoria sistemelor şi reglare automată, M. Abrudean, Ed. Mediamira 1998, ISBN: 973 – 2398 – 11-x.
8. Conducerea automată a proceselor industriale, M. Vînătoru., Craiova, 2001

9.2 Seminar / laboratory / project	Hours HEI	Hours CO	Teaching methods	Obs.
Laboratory			Explanations and demonstrations, discussions, case study, teamwork	
1. Introduction in BS (Base layer design)		4		
2. Flow and Level control structures		4		
3. Pressure and Temperature control structures		4		
4. Tunning and monitoring Tools		4		
5. Master – Slave PID control structures and Cascade Control structures		4		
6. Feedforward control structures, ratio control structures, split-range control, override control		4		
7. Evaluation Lab		4		

Bibliography

1. PAS 001 Engineering level 1
2. PAS 004 Engineering level 1
3. Books Online for DeltaV

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

Lectures and applications content was discussed with field experts for HEI

11. Evaluation

Activity Type	Evaluation criteria	Evaluation methods	Weight in final grade
11.1 Lecture	Acquired theoretical knowledge about the modeling-control of the industrial processes	Written exam. Problem solving	50%
11.2 Seminar/ Laboratory/Project	Acquired practical knowledge and abilities related to the design and implementation of control loops for industrial processes	Problem solving	50%
11.3 Minimum Performance Standard			
Grade at exam ≥ 5 Grade at laboratory ≥ 5 *The final grade is calculated as: 0.5 * Exam + 0.5 * Laboratory*			

Date of completion:	Lecturers	Title First Name LAST NAME	Signature
15.09.2025	Course	Conf.Dr.Ing. Iulia CLITAN	

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