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	42.00

2. Course information

2.1 Course title				**Automatic Monitoring and Control Systems**		
2.2 Course lecturer				*Conf.Dr.Ing. Avram Camelia – camelia.avram@aut.utcluj.ro*		
2.3 Seminar / Laboratory / Project Lecturer				*Ing. Vlad Roșca (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	10	10
(b) Additional documentation in the library, specialized electronic platforms, and fieldwork	6	6
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	3	3
(d) Tutoring	1	1
(e) Examinations	2	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	• Introduction to System Theory and Control Systems • Process Modelling • Control Engineering
4.2 Competency Prerequisites	• Computer programming • Logic Design

5. **Conditions** (where applicable)

5.1. Course Organization Conditions	• The lecture room is equipped with a video projector and internet access.
5.2. Seminar / Laboratory / Project organization conditions	• Laboratory equipped with DeltaV simulation environment, demo environment, and virtualization infrastructure or cloud VMS access. • Attendance at the laboratory is mandatory.

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 Competencies	• TC01 Apply knowledge of science, technology and engineering • TC03 Demonstrate responsibility • TC04 Work in teams

7. Learning outcomes

Knowledge:	• The student identifies and summarizes fundamental concepts of automation, modeling, identification, simulation, and analysis methods for processes, computer-aided design techniques for classical and intelligent automatic systems, and their application to real problems.
Skills:	• The student interprets and explains automation problems of various processes using basic principles from systems theory, automatic control engineering, modeling and simulation, computer-aided design techniques, and system engineering-specific analysis methods. • The student recognizes and implements complex architectures for intelligent autonomous systems. • The student will be able to specifies requirements, develops simulation scenarios, and proposes solutions for solving control problems.
Responsibility and autonomy:	• By law, the student/graduate behaves honorably, responsibly, and ethically to uphold the profession's reputation.

8. Course Objectives

8.1 General objective of the course	• Understanding and applying formal methods for modelling, analysis, synthesis and control systems
8.2 Specific objectives	• Design and specify control system functionality for industrial processes. • Select appropriate sensors, actuators, and I/O interfaces. • To develop and implement advanced control techniques based on suitable formal models. • Simulate and validate system behavior before deployment. • Analyze system performance and perform fault diagnostics.

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
Lecture 1. Introduction to Monitoring and Control Systems	2	Modern and traditional methods	Attendance is mandatory
Lecture 2. Functional Specification of Control Systems	2		
Lecture 3. I/O Systems and Signal Conditioning	2		
Lectures 4. Communication and Networking in Control Systems	4		

Lectures 5 & 6. Control System Implementation Frameworks	4			
Lectures 7 & 8. Application of Control Algorithms	4			
Lecture 9 & 10. Monitoring Strategies and State Estimation	2			
Lecture 11. Human-Machine Interfaces (HMI) for Monitoring Systems	2			
Lecture 12. Simulation and Testing Tools	2			
Lecture 13. Control Validation Methods	2			
Lecture 14. Commissioning of Industrial Processes	2			

Bibliography

1. Seborg, D. E., Edgar, T. F., Mellichamp, D. A., & Doyle, F. J.; "Process Dynamics and Control"; Ed. Wiley.
2. Marlin, Thomas E.; "Process Control: Designing Processes and Control Systems for Dynamic Performance", McGraw-Hill;
3. Stenerson, J., "Fundamentals of Programmable Logic Controllers, Sensors and Communications", Prentice Hall;

9.2 Seminar/laboratory/project	Hours HEI	Hours CO	Teaching methods	Obs.
Laboratory 1. Signal Mapping, I/O and Control Modules Configuration		4	Interactive methods, examples, and practical applications	Mandatory attendance
Laboratory 2. Implementing PID Control in DeltaV. Design a PID loop for a simulated process (tank level).		4		
Laboratory 3. Implementing PID Control in DeltaV. Tune controller parameters and monitor response.		4		
Laboratory 4. Create custom HMI screens in DeltaV Operate.		4		
Laboratory 5. Configure alarms, trends, and operator actions.		4		
Laboratory 6. Simulation and function testing. Use DeltaV Simulate for offline testing.		4		
Laboratory 7. Simulation and function testing. Process simulations and verify control logic.		4		

Bibliography:

1. 7009 – DeltaV System Implementation 1
2. 7018 – DeltaV Hardware and Troubleshooting

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

Automatic monitoring and control systems align with higher education requirements and those set by companies.

From an industry standpoint, the course has been designed in consultation with emerging trends and practical needs expressed by major employers.

This course builds upon prior theoretical knowledge and develops competence in application and system-level thinking, a recurring requirement in industry job postings and competency frameworks. Including hands-on lab sessions, simulation tools, and project-based learning fosters problem-solving skills, system integration capabilities, and digital fluency.

11. Evaluation

Activity Type	Evaluation criteria	Evaluation methods	Weight in final grade
11.1 Lecture	The capacity to use knowledge and creativity.	Written exam.	50%

	Correct utilization of techniques or means of expression specific to the field.		
11.2 Seminar/ Laboratory/Project	Choices consistent with the objective and with the intent developed. The development of relevant skills.	- Methods of checking homework - Assessment of laboratory work	50%
11.3 Minimum Performance Standard Final exam >=5 Lab grade>=5 mandatory to be able to take the final exam **50% Final exam + 50% Lab Grade > 5**			

Date of completion: 16.05.2025	Lecturers		Signature
	Course	Conf. Dr. Ing. Camelia Claudia AVRAM	
	Applications		

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