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	41.00

2. Course information

2.1 Course title				**Hydro-Pneumatic Control Equipment**	
2.2 Course lecturer				*Prof. Dr. Ing. Levente Tamas (Levente.Tamas@aut.utcluj.ro)*	
2.3 Seminar / Laboratory / Project Lecturer				*Prof. Dr. Ing. Levente Tamas* *Ing. Eduard-Andrei Cezar*	
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	1	Project	0
			CO		0		0		1		0
3.2 Number of hours per semester	56	of which:	HEI	Lecture	28	Seminar	0	Laboratory	14	Project	0
			CO		0		0		14		0

3.3 Distribution of time allocation (hours per semester) for:	HEI	CO
(a) Study based on textbook, course support, bibliography, and notes	2	0
(b) Additional documentation in library, specialized electronic platforms, and fieldwork	1	1
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	2	8
(d) Tutoring	0	0
(e) Examinations	3	2
(f) Other activities:	0	0
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	8	11
3.5 Total hours per semester (3.2+3.4)	50	25
3.6 Number of credits per semester	2	1

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	• Control engineering • Introduction to system theory and Control Systems • Process modelling • Mechanical Engineering
4.2 Competency Prerequisites	• Design and implementation of industrial control loops including electrical and hydro-pneumatic equipment. • English

5. Conditions (where applicable)

5.1. Course Organization Conditions	• Attendance is compulsory. Reading and understanding the lecture notes.
5.2. Seminar / Laboratory / Project organization conditions	• Attendance is compulsory.

6. Specific Competencies Acquired

Professional Competencies	• PC02 Analyse test data • PC03 Approve engineering design • PC04 Conduct literature research • PC06 Define technical requirements • PC08 Design automation components • PC12 Gather technical information • PC13 Interact professionally in research and professional environments • PC26 Use information technology tools • PC29 Come up with solutions to problems • PC30 Design control systems
Transversal Competencies	• TC01 Apply knowledge of science, technology and engineering • TC03 Demonstrate responsibility

7. Learning outcomes

Knowledge:	• Apply system engineering principles to design, analyze, and optimize hydro-pneumatic systems, demonstrating an understanding of their components, integration, and performance evaluation
Skills:	• Design, implement, and test hydro-pneumatic systems, ensuring their functionality and reliability in various operational conditions. • Effectively use and maintain hydro-pneumatic systems, including troubleshooting and providing ongoing support to optimize system performance. • Apply advanced techniques for testing and evaluating the performance of hydro-pneumatic systems, identifying and resolving issues to ensure efficient operation.
Responsibility and autonomy:	• Demonstrate the ability to independently analyze P&ID diagrams and evaluate standard hydro-pneumatic control loops, taking full responsibility for ensuring compliance with industry standards and specifications. • Autonomously assess the performance of hydro-pneumatic control systems, including the ability to generate accurate quotations and propose suitable solutions based on P&ID understanding and system requirements. • Develop the responsibility to interpret P&ID diagrams and evaluate hydro-pneumatic control loops, exercising autonomy in making decisions related to system performance and quotation within industry guidelines.

8. Course Objectives

8.1 General objective of the course	• To provide students with knowledge and skills to design, implement, test, use, support and operate control systems using fluid power.
8.2 Specific objectives	• To provide students with knowledge of the design and functional principles of the hydro-pneumatic equipment. • Application and testing of the HP control systems.

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
Introduction to the hydraulic-pneumatic systems	2	Presentation using beamer/online sharing possible	
Theoretical aspects of the fluids	2		
Passive circuit elements	2		
Active circuit elements	2		
Applications to active-passive circuit elements	2		
Pneumatic actuators with membranes	2		

Pneumatic transducers	2		
Pneumatic cylinder control equipment	2		
Discrete pneumatic circuits	2		
Hydraulic sources and motors	2		
Hydraulic control systems	4		
Case study of a control loops	4		

Bibliography
1 DeltaV book online.
2. A.Hanieh – Fluid Power Control : Hydraulics and Pneumatics- Cambridge Publishing. 2012.
3. James Daines - Fluid Power: Hydraulics and Pneumatics, Goodheart Willcox Publ., 2009
4. Gh.Lazea, R.Robotin, S.Herle, C.Marcu – Echipamente de automatizare pneumatic si hidraulice UTPress 2006

9.2 Seminar / laboratory / project	Hours HEI	Hours CO	Teaching methods	Obs.
Flow measurement with restrictor and piezo components	4	0	Practical work including computation and discussion/or online variant on Teams	Encouraging team work: 2-3 students in a group
Pneumatic amplifiers.	4	0		
Electro-pneumatic converter, actuators and transducers	4	0		
Simulation of the pneumatic circuits	2	0		
DP flow measurement	0	4		
Industrial control system loops using HP with P&ID	0	4		
Application with pneumatic equipment	0	6		

Bibliography
1. L. Tamas et. al.: Hydraulic and Pneumatic Control Equipment –laboratory book, UTPress, 2015

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

Actuation equipment used in industrial process automation and proposed specific HP control systems based customer needs.

11. Evaluation

Activity Type	Evaluation criteria	Evaluation methods	Weight in final grade
11.1 Lecture	Theoretical concepts Analytic and synthetic work	Written exam/or online exam on Teams	5 from 10
11.2 Seminar/ Laboratory/Project	Understanding the laboratory work as well as performing the hands on part	Laboratory colloquium / or online evaluation	5 from 10
11.3 Minimum Performance Standard 5 out of 10			

Date of completion: 15.09.2025	Lecturers		Signature
	Course	Prof. dr. ing. Levente Tamas	
	Applications	Prof. dr. ing. Levente Tamas	

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