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	47.00

2. Course information

2.1 Course title	**Industrial Communication Networks**					
2.2 Course lecturer	*Conf. Dr. Ing Camelia Claudia AVRAM - camelia.avram@aut.utcluj.ro*					
2.3 Seminar / Laboratory / Project Lecturer	*Dr.Ing.Sergiu PAŞCU (Emerson)* *Ing. Andrei CIOATA (Emerson)*					
2.4 Year of study	4	2.5 Semester	1	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 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	3

(HEI = Higher Education Institution, CO = Company)

4. **Prerequisites** (where applicable)

4.1 Curriculum Prerequisites	• Industrial Automation Platforms • Computer Architecture, Operating Systems and Fundamentals of Computer Networking • Digital Transformation • Measurement and Transducers • Process Modelling • Software Engineering and Databases • Electric and Electronic Control Equipment • Electrical Machine and Drives • Signal Processing • Power Electronics in Automation Control • Automatic Monitoring and Control systems • Computer Networks

	• Hydro-pneumatic Control Equipment • System Engineering I
4.2 Competency Prerequisites	• A basic understanding of industrial control systems, knowledge of programming, and the fundamentals of automation system design from *System Engineering I.*

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 • PC06 Define technical requirements • PC07 Demonstrate disciplinary expertise • PC08 Design automation components • PC12 Gather technical information • PC15 Manage research data • PC26 Use information technology tools • PC30 Design control systems • PC31 Use remote control equipment
Transversal Competencies	• TC01 Apply knowledge of science, technology and engineering • TC02 Think analytically

7. Learning outcomes

Knowledge:	Upon completion of the course, the student will be able to: • **Describe and summarize** the structure of industrial protocols, including the standards, integration in distributed control systems (DCS) with emphasis on DeltaV and Ovation platforms. • **Explain** the interaction between different devices/ skids / PLCs and DCS systems and how these are implemented in DeltaV and Ovation environments. • **Identify and categorize** the architectural components of different devices/ skids / PLC and their roles in industrial applications.
Skills:	The students will be able to: • **Apply** industrial protocol concept to the design and analysis of procedural and physical models. • **Develop and simulate** protocol integration logic in DeltaV Control Studio. • **Configure and test** a protocol integration in DeltaV DCS. • **Utilize** dedicated tools (DeltaV Operate, DeltaV Live) to monitor and control different industrial protocols.
Responsibility and autonomy:	At the end of the course, the students will: • **Demonstrate responsibility** in designing integration of industrial protocols in DeltaV DCS. • **Collaborate effectively** in multidisciplinary teams to complete project-based integration tasks involving industrial protocols.

	• **Document and justify** technical decisions in project reports and presentations, using industry-standard terminology and structure. • **Adapt and innovate** solutions in response to integration challenges and operational constraints found in regulated industrial environments.

8. Course Objectives

8.1 General objective of the course	• To provide students with advanced knowledge and practical skills in distributed control systems design, focusing on the integration between DeltaV / Ovation and different industrial protocols.
8.2 Specific objectives	• Explain industrial automation architectures and standards. • Use DeltaV tools to implement protocol logic. • Understand and configure industrial protocol modules and workflows. • Enable secure communication and data flow between DCS systems and industrial protocols.

9. Contents

9.1 Lectures	**No. of hours**	**Teaching methods**	**Obs.**
1. Industrial Automation Overview	2	Comprehensive slides Blackboard annotations Oriented discussions on the subject	
2. DeltaV DCS – System Architecture & Design	2		
3. Physical control – EQM	2		
4. Protocol Standards I: Serial 232, Serial 485, Modbus TRU, Profibus DP, Profibus PA, Foundation Filedbus	2		
5. Protocol Standards II: Modbus TCP/IP, Profinet, IEC 6185, Device Net, AS-i, OPC	2		
6. Complete Protocol Examples	2		
7. Network system architecture	2		
8. DeltaV and Ovation Protocol licensing	2		
9. Protocols for Skids system integration	2		
10. Full protocol Process Walkthrough	2		
11. Working with Multi-DCS Environments	2		
12. Protocol Operation in Practice	2		
13. Graphic displays, faceplate, dynamos	2		
14. Operator Interface & Alarm Handling & Plant Admin & Engineering Tools	2		

Bibliography:

1. PAS002 – PCSD EQM
2. Protocol standards
3. 7009 – DeltaV System Implementation 1
4. 7018 – DeltaV Hardware and Troubleshooting

9.2. Seminar / laboratory / project	**Hours HEI**	**Hours CO**	**Teaching methods**	**Obs.**
1. DeltaV Studio – Basic Setup and Simulation		4	Guided practical	
2. Modeling Physical & Procedural Elements in DeltaV - EQM		4	Hands-on modeling	
3. Licensing in DeltaV		4	Task-based exercise	
4. Monitoring & Control		4	Simulation, monitoring and control	

5. Graphic displays, faceplate, dynamos creation		4	Live analysis	
6. Alarm Handling and Operator Intervention		4	Guided navigation	
7. Protocols – DCS Integration Demo		4	Integration setup	

Bibliography

1. PAS002 – PCSD EQM
2. Protocol standards
3. 7009 – DeltaV System Implementation 1
4. 7018 – DeltaV Hardware and TR
5. 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

This course aligns with current demands in all industrial environments. The curriculum incorporates Emerson technologies and protocol standards, ensuring high relevance to employers such as Emerson, Siemens, Schneider and digital transformation consultancies. The course supports job roles such as automation engineer, process control engineer, and DCS integration specialist.

11. Evaluation

Activity Type	**Evaluation criteria**	**Evaluation methods**	**Weight in final grade**
11.1 Lecture	Understanding key concepts, terminology, and standards	Written final exam	50%
11.2.1 Seminar/ Laboratory/Project	Practical skill in using DeltaV and Ovation	In-class evaluation	50%

11.3 Minimum Performance Standard

Understand and apply basic protocol standards, demonstrate integration of different industrial protocols in DeltaV and Ovation

- 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:	Lecturers		Signature
16.05.2025	Course	Conf.Dr.Ing. Camelia Claudia AVRAM	
	Applications		

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