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	37.00

2. Course information

2.1 Course title	**Digital Twin in Process Automation**					
2.2 Course lecturer						
2.3 Seminar / Laboratory / Project Lecturer	*Ing. Roxana Sav (Emerson)*					
2.4 Year of study	3	2.5 Semester	1	2.6 Type of assessment		
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		Seminar		Laboratory		Project	4
			CO		0		0				
3.2 Number of hours per semester	56	of which:	HEI	Lecture		Seminar		Laboratory		Project	56
			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	0	30
(b) Additional documentation in library, specialized electronic platforms, and fieldwork	0	0
(c) Preparation of seminars/laboratories, assignments, papers, portfolios and essays	0	15
(d) Tutoring	0	0
(e) Examinations	0	8
(f) Other activities:	0	15
3.4 Total individual study hours (sum (3.3(a)... 3.3(f)))	0	69
3.5 Total hours per semester (3.2+3.4)	0	125
3.6 Number of credits per semester	0	5

(HEI = Higher Education Institution, CO = Company)

4. Prerequisites (where applicable)

4.1 Curriculum Prerequisites	• Industrial Automation Platforms (Company project - sem1) Digital Transformation (Company project - sem 3)
4.2 Competency Prerequisites	• Ability to independently identify and navigate DeltaV and Mimic applications. • Ability to understand and interpret technical documentation (P&IDs, datasheets).

5. Conditions (where applicable)

5.1. Course Organization Conditions	N/A
5.2. Seminar / Laboratory / Project organization conditions	• Laptop, Specific Software access

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 • PC25 Use technical drawing software • PC26 Use information technology tools • PC30 Design control systems
Transversal Competencies	• TC01 Apply knowledge of science, technology and engineering • TC03 Demonstrate responsability • TC04 Work in teams • TC05 Interpret mathematical information

7. Learning outcomes

Knowledge:	• The student will be able to **describe the architecture and communication** between DeltaV and Mimic / Hysys in the context of Digital Twin systems, explaining the role of each component. • The student will be able to **understand modeling fidelity concepts** and the use of data from PFDs, P&IDs and datasheets in simulation configuration. • The student will be able to **identify the testing and validation methods** applied prior and during Factory Acceptance Testing (FAT) of Digital Twins.
Skills:	• The student will be able to **configure tiebacks**, using specific integration tools such as FHX Utility and Bulk Generation Utility. • The student will be able to **configure simulation models using Mimic / Hysys** based on data from P&IDs and datasheets. • The student will be able to **use visualization and testing tools**, such as Component Studio, Test Bench, Mimic Train.
Responsibility and autonomy:	• The student will be able to **participate in team-based project activities**, contributing to the execution of tasks related to Digital Twin implementation. • The student will be able to **follow and understand the stages and requirements** of a Digital Twin project development, under guidance, while gradually taking responsibility for specific project tasks. • The student will be able to **describe and present the activities they were involved in**, demonstrating understanding of the process and clarity in communication.

8. Course Objectives

8.1 General objective of the course	• This course provides students with a foundational understanding of Digital Twin systems by exploring the integration between DeltaV and Mimic (Hysys) platforms, the simulation with Mimic (Hysys) of different modeling fidelities and the training capabilities using Mimic Train. Students develop their practical skills in configuration, simulation and testing of process automation environments.

8.2 Specific objectives	• Understand the structure, workflow and timeline of a Digital Twin project. • Familiarize with DeltaV–Mimic / Hysys communication protocols. • Configure integration tools such as FHX Utility and Bulk Generation Utility. • Configure and execute Test Bench scripts for integration testing. • Interpret and extract relevant data from engineering documentation such as P&IDs and datasheets. • Build simulation models using Simulation Studio / Hysys of a specific modeling fidelity. • Use visualization tools like Component Studio for HMI design. • Explore training system functionalities with Mimic Train and snapshot coordination using Snapshot Control. • Test the Digital Twin and participate in a FAT (Factory Acceptance Test) like process.

9. Contents

9.1 Lectures	No. of hours	Teaching methods	Obs.
NA			
Bibliography			

9.2 Seminar / laboratory / project	Hours HEI	Hours CO	Teaching methods	Obs.
1. Orientation and Project Planning: Understanding the Structure, Resources and Timeline of Emerson Digital Twin Initiatives.		4	Providing documentation and access to workshops and guided exercises. Delivering presentations, training sessions and technical demonstrations. Hands-on work. Discussions.	
2. Mimic / Hysys Digital Twin: Introduction to DeltaV – Mimic - Hysys Communication. DeltaV SIO Drivers / Hysys Endpoint configuration.		4		
3. Mimic / Hysys Digital Twin: Integration fundamentals and tools. DeltaV FHX Utility and Bulk Generation Utility configuration.		8		
4. Mimic / Hysys Digital Twin: Integration testing. Test Bench configuration.		8		
5. Mimic / Hysys Digital Twin: Modeling Fidelity general concept and applications. P&IDs, Datasheets data. Simulation Studio / Hysys configuration.		12		
6. Mimic / Hysys Digital Twin: Mimic View tools. Component Studio configuration.		4		
7. Mimic / Hysys Digital Twin: Training (OTS) fundamentals and tools. Snapshot Control and Mimic Train configuration.		8		
8. Mimic / Hysys Digital Twin: Testing. FAT (Factory Acceptance Test). Evaluation.		8		
Bibliography 1. 7601 - Mimic Dynamic Simulation 2. 7602 - Mimic Advanced Fluid Modeling Objects 3. 7631 - Dynamic Simulation Introduction				

4. 7632 - DeltaV Mimic Introduction
5. Aspen HYSYS Dynamics: Introduction to Dynamic Modeling

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 course aligns with industry standards and employer expectations, ensuring that students develop relevant competencies in Emerson Digital Twin technologies such as simulation tools widely adopted in industry.

11. Evaluation

Activity Type	**Evaluation criteria**	**Evaluation methods**	**Weight in final grade**
11.1 Lecture	NA	NA	NA
11.2 Seminar/ Laboratory/Project	Understanding of core concepts Practical ability to configure tools Accuracy and completeness of project implementation Team collaboration and participation	Practical applications Project evaluation Oral presentation	100%
11.3 Minimum Performance Standard			
50% out of 100&			

Date of completion: 11.05.2025	Program responsible	Conf.dr.ing. Roxana Rusu-Both	

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