SYLLABUS

1. Information about the program

1.1 Higher education institution	Politehnica University Timisoara
1.2 Faculty[1]/ Department [2]	Chemical Engineering, Biotechnologies and Environmental Protection / CAICON
1.3 Field of study (name/code[3])	Chemical Engineering / 10.30.50
1.4 Study cycle	License
1.5 Study program (name/code/qualification)	Chemical Engineering / 10.30.50.60 / engineer

2. Information about the discipline

2.1 Name of discipline/ formative category[4]	Modern systems for automatic management of processes in the chemical industry / DS						
2.2 Coordinator (holder) of course activities	Prof.dr.ing. Gabriela-Alina DUMITREL						
2.3 Coordinator (holder) of applied activities[5]	Ș.L.dr.ing. Valentin ORDODI						
2.4 Year of study[6]	IV	**2.5** Semester	8	**2.6** Type of evaluation	E	**2.7** Regime of discipline[7]	DO

3. Total estimated time – hours / semester: direct teaching activities (fully assisted or partly assisted) and individual training activities (unassisted) [8]

3.1 Number of fully assisted hours / week	3.5 of which:	**3.2** course	2	**3.3** seminar / laboratory / project	0/1.5/0
3.1* Total number of fully assisted hours / semester	49 of which:	**3.2*** course	28	**3.3*** seminar / laboratory / project	0/21/0
3.4 Number of hours partially assisted / week	of which:	**3.5** training		**3.6** hours for diploma project elaboration	
3.4* Total number of hours partially assisted / semester	of which:	**3.5*** training		**3.6*** hours for diploma project elaboration	
3.7 Number of hours of unassisted activities / week	5.43 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			2.15
		hours of individual study after manual, course support, bibliography and notes			1.78
		training seminars / laboratories, homework and papers, portfolios and essays			1.5
3.7* Number of hours of unassisted activities / semester	76 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			30
		hours of individual study after manual, course support, bibliography and notes			25
		training seminars / laboratories, homework and papers, portfolios and essays			21
3.8 Total hours / week [9]	8.93				
3.8* Total hours /semester	125				
3.9 Number of credits	5				

4. **Prerequisites** (where applicable)

4.1 Curriculum	• Physics, Informatics, Electrotechnics, Electronics, Hydrodynamics, Heat

[1] The name of the faculty which manages the educational curriculum to which the discipline belongs
[2] The name of the department entrusted with the discipline, and to which the course coordinator/holder belongs.
[3] The code provided in HG - on the approval of the Nomenclature of fields and specializations / study programs, annually updated.
[4] Discipline falls under the educational curriculum in one of the following formative disciplines: Basic Discipline (DF), Domain Discipline (DD), Specialist Discipline (DS) or Complementary Discipline (DC).
[5] Application activities refer to: seminar (S) / laboratory (L) / project (P) / practice/training (Pr).
[6] Year of studies in which the discipline is provided in the curriculum.
[7] Discipline may have one of the following regimes: imposed discipline (DI) or compulsory discipline (DOb)-for the other fundamental fields of studies offered by UPT, optional discipline (DO) or optional discipline (Df).
[8] The number of hours in the headings 3.1 *, 3.2 *, ..., 3.8 * is obtained by multiplying by 14 (weeks) the number of hours in headings 3.1, 3.2, ..., 3.8. The information in sections 3.1, 3.4 and 3.7 is the verification keys used by ARACIS as: (3.1) + (3.4) ≥ 28 hours / wk. and (3.8) ≤ 40 hours / wk.
[9] The total number of hours / week is obtained by summing up the number of hours in points 3.1, 3.4 and 3.7.

	transfer, Automation in the chemical industry, Numerical process management equipment
4.2 Competencies	• Basic knowledge in the field of electrical engineering, electronics, automation and IT

5. Conditions (where applicable)

5.1 of the course	• The classroom is equipped with a blackboard and a video projector
5.2 to conduct practical activities	• Laboratory equipped with blackboard and video projector, with experimental setups, respectively with computers and appropriate software programs

6. Specific competencies acquired through this discipline

Specific competencies	• Understanding the operating principles of modern systems for automatic control of processes in the chemical industry. • Development of modern process management systems in the chemical industry
Professional competencies ascribed to the specific competencies	• - Analyse production processes for improvement; • - Manage chemical testing procedures; • - Test materials; • - Write technical reports • -Performs chemical experiments • -Approve engineering design • -Assess environmental impact

Transversal competencies ascribed to the specific competencies

- - Conduct quality control;
- - Apply scientific, technological and engineering knowledge;
- - Uses equipment, instruments or technological equipment accurately.

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7. Objectives of the discipline (based on the grid of specific competencies acquired - pct.6)

7.1 The general objective of the discipline	• Assimilation of knowledge regarding modern process management systems in chemical engineering
7.2 Specific objectives	• Understanding the management principles of chemical processes with modern systems. • Developing skills to manage chemical engineering processes using modern systems

8. Content [10]

8.1 Course	Number of hours	Teaching methods [11]
Multiple loop control systems: cascaded, selective, split control	4	Interactive teaching, lecture, demonstration,
Ratio regulation systems	3	

[10] It details all the didactic activities foreseen in the curriculum (lectures and seminar themes, the list of laboratory works, the content of the stages of project preparation, the theme of each practice stage). The titles of the laboratory work carried out on the stands shall be accompanied by the notation "(*)".

[11] Presentation of the teaching methods will include the use of new technologies (e-mail, personalized web page, electronic resources etc.).

Adaptive control systems	3	problem solving, case study, cooperative learning methods and techniques; Exposure with a video projector for fixing and consolidating knowledge.
Inferential control systems	4	
Predictive tuning by model	4	
Modern driving systems with programmable automatics	4	
Interaction of regulation systems	3	
Examples of automated process management with modern systems	3	

Bibliography [12] 1. Cecil L. Smith, Advanced Process Control: Beyond Single-Loop Control, John Wiley & Sons, Inc., Hoboken, New Jersey, 2010.
2. Introduction to Advanced Process Control Techniques, https://old.amu.ac.in/emp/studym/100012558.pdf
3. Thomas E. Marlin, Process Control Designing Processes and Control Systems for Dynamic Performance, McGraw-Hill, 2015.

8.2 Applied activities [13]	Number of hours	Teaching methods
Labor protection in the laboratory. Power supplies with multiple voltages. Practical schemes. Experimental determination of the main parameters	2	Practical activity
Power amplifiers. Electromagnetic relays. Solid state relays. Practical installations. Experimental determinations	4	Practical activity
Adjustment of some process parameters with PLC. Case studies	4	Practical activity
Study of the static and dynamic behavior of a proportional-integral regulator implemented with Arduino	4	Practical activity
Optimal tuning of a PID controller equipped with a microcontroller	4	Practical activity
Advanced temperature regulation systems. Case study: the jacketed reactor.	2	Practical activity
Laboratory test	1	Test

Bibliography [14]
1. Sebastian Petru Sabou. Îndrumător laborator microcontrolere ARDUINO. U.T. PRESS CLUJ-NAPOCA, 2018
2. Laura Grindei Claudia Constantinescu Marius Purcar. Aplicaţii C/C++/C# şi Arduino în Inginerie Electrică, U.T. PRESS Cluj-Napoca, 2020
3. Iordache Valentin, Cormoș Angel Ciprian, Costea Ilona Mădălina. Senzori, traductoare și achizitii de date cu Arduino Uno. Lucrări Practice. Ediție revizuită. Editura Politehnica pess, București, 2019
4. Mărgineanu, I., Utilizarea automatelor programabile în controlul proceselor, Editura Albastră, Cluj-Napoca, 2010
5. Hackworth, J., R., Hackworth, F., D. Programmable Logic Controllers: Programming Methods and Applications, Prentice Hall, 2004
6. Jones, C., T., Programmable Logic Controllers, Patrick-Turner, 1996

9. Corroboration of the content of the discipline with the expectations of the main representatives of the epistemic community, professional associations and employers in the field afferent to the program

- The proposed content is structured in accordance with the requirements in the field, being similar to the disciplines in profile universities in the country and abroad.
- • The content of the discipline was drawn up taking into account the needs and expectations of employers in the field. These were identified through discussions at the level of the Board of the field, which also includes representatives of the economic environment.
- • The skills acquired will be necessary for employees working in industry units, research and design units, etc.

10. Evaluation

Type of activity	**10.1** Evaluation criteria [15]	**10.2** Evaluation methods	**10.3** Share of the final grade

[12] At least one title must belong to the discipline team and at least one title should refer to a reference work for discipline, national and international circulation, existing in the UPT library.
[13] Types of application activities are those specified in footnote 5. If the discipline contains several types of applicative activities then they are sequentially in the lines of the table below. The type of activity will be in a distinct line as: "Seminar:", "Laboratory:", "Project:" and / or "Practice/training".
[14] At least one title must belong to the discipline team.
[15] Syllabus must contain the procedure for assessing the discipline, specifying the criteria, methods and forms of assessment, as well as specifying the weightings assigned to them in the final grade. The evaluation criteria shall be formulated separately for each activity foreseen in the curriculum (course, seminar, laboratory, project). They will also refer to the forms of verification (homework, papers, etc.)

10.4 Course	Knowledge of the fundamental notions of modern process management systems in the chemical industry	Written exam, 3 hours	66%
10.5 Applied activities	**S:**		
	L: Assessment of skills practical to create and program a simple application with Arduino	Laboratory test	34%
	P[16]**:**		
	Pr:		
10.6 Minimum performance standard (minimum amount of knowledge necessary to pass the discipline and the way in which this knowledge is verified [17])			
• Acquiring basic knowledge of modern process control systems in the chemical and biochemical industry. The final grade is the weighted average of the course and laboratory components. The minimum passing average is 5, cu • The condition that each component grade is at least equal to 5. All sessions have the same grading criteria			

Date of completion	**Course coordinator (signature)**	**Coordinator of applied activities (signature)**
	Prof. dr. ing. Alina – Gabriela DUMITREL	Ș. L. Dr. Ing. Ordodi Laurențiu Valentin

Head of Department (signature)	**Date of approval in the Faculty Council** [18]	**Dean (signature)**
S.L.dr.ing. Andra TĂMAȘ		Ș.L.dr.ing. Mircea Laurențiu DAN

[16] In the case where the project is not a distinct discipline, this section also specifies how the outcome of the project evaluation makes the admission of the student conditional on the final assessment within the discipline.
[17] It will not explain how the promotion mark is awarded.
[18] The endorsement is preceded by the discussion of the board's view of the study program on the discipline record.