

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	Automation in chemical industry / DD						
2.2 Coordinator (holder) of course activities	Prof.dr.ing. Gabriela-Alina DUMITREL						
2.3 Coordinator (holder) of applied activities ⁵	Ș.I. dr. ing. Ana-Maria PANĂ, ș.I.dr.ing. Valentin Ordodi						
2.4 Year of study ⁶	III	2.5 Semester	6	2.6 Type of evaluation	E	2.7 Regime of discipline ⁷	DI

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	4.5 of which:	3.2 course	2.5	3.3 seminar / laboratory / project	0/2/0
3.1* Total number of fully assisted hours / semester	63 of which:	3.2* course	35	3.3* seminar / laboratory / project	0/28/0
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	0.86 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			0.3
		hours of individual study after manual, course support, bibliography and notes			0.3
		training seminars / laboratories, homework and papers, portfolios and essays			0.26
3.7* Number of hours of unassisted activities / semester	12 of which:	additional documentary hours in the library, on the specialized electronic platforms and on the field			4
		hours of individual study after manual, course support, bibliography and notes			4
		training seminars / laboratories, homework and papers, portfolios and essays			4
3.8 Total hours / week ⁹	5.36				
3.8* Total hours /semester	75				
3.9 Number of credits	3				

4. Prerequisites (where applicable)

4.1 Curriculum	<ul style="list-style-type: none"> Physical chemistry, Hydrodynamics, Heat and mass transfer
4.2 Competencies	<ul style="list-style-type: none"> Basics in the field of chemistry and chemical engineering

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.

5. Conditions (where applicable)

5.1 of the course	<ul style="list-style-type: none"> Classroom provided with writing board, internet access and video-projector
5.2 to conduct practical activities	<ul style="list-style-type: none"> Laboratory equipped with experimental stands that would enable demonstration of chemical processes automation

6. Specific competencies acquired through this discipline

Specific competencies	<ul style="list-style-type: none"> Knowledge of automation systems structures specific for equipment and installations in chemical industry. Knowledge of working principles for measuring elements, controllers, execution elements inside an automated system. Knowledge of general principles for automated control of equipment and the ability to design control systems for specific equipment and installation in chemical industry. Acquiring information for development of evolved control systems in chemical industry.
Professional competencies ascribed to the specific competencies	<ul style="list-style-type: none"> - 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.

<ul style="list-style-type: none">
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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	<ul style="list-style-type: none"> The general objective of this discipline is to provide students with basic knowledge for measuring and monitoring parameters in chemical industries, to familiarize them with specific devices, the principles of control systems, their operation and advanced control.
7.2 Specific objectives	<ul style="list-style-type: none"> Understanding the working principles of automation systems used in chemical industry. Reading and interpretation of automation schemes attached to the installation from chemical industry. Acquiring necessary elements for designing conventional or evolved control systems for certain equipment or installation from chemical industry. Assessment of working efficiency for an automated control system.

8. Content ¹⁰

8.1 Course	Number of hours	Teaching methods ¹¹
Automated systems. Fundamentals	3	Interactive teaching skills, lecture, demonstration, problem solving,
Automated control theory. Standard input signals and system output. Possibilities of connection for control elements inside automated systems	6	

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.).

Laws of control for automated systems – case study for equipment in chemical industry. Process dynamics	6	cooperation teaching. Video-projector lecture and black-board explanations for knowledge consolidation. Case study analysis based on video materials.
Control device – structure, block diagram. Fundamentals of mathematical analysis for automated control systems	4	
Automated control for main parameters of chemical processes	6	
Evolved control systems in chemical industry	6	
Examples of automated control using conventional devices and computers for several technological processes	4	
Bibliography ¹² 1. Delia Perju, Suta Marcel, Carmen Rusnac, Gabriela-Alina Brusturean (cas. DumitreI) – Automatizarea proceselor chimice Aplicații 1, Editura Politehnica, Timișoara, 2005. 2. DumitreI G.A., Automatizarea proceselor chimice, note de curs, disponibil online, https://cv.upt.ro/course/view.php?id=2267 3. Delia Perju, Suta Marcel, Mircea Geantă, Carmen Rusnac – Automatizarea proceselor chimice, Partea I, Editura „Mirton”, Timișoara, 1998. 4. Silvia Curteanu, Stefan Ungureanu – Automatizări în industria chimică, Universitatea Tehnică „Gh Asachi” Iași, Facultatea de chimie industrială, 2000. 5. Agachi Serban – Automatizarea proceselor chimice, Casa Cărții de Știință, Cluj Napoca, 1994 6 . Jose Alberto Romagnoli, Introduction to process control. Boca Raton, London, New York, CRC Press, c2012. 7. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III, Process Dynamics and Control, Third Edition, Wiley, 2011		
8.2 Applied activities ¹³	Number of hours	Teaching methods
Safety regulation in the automation laboratory. Signs and symbols used in automation schemes of chemical processes. Experimental data interpretation using Excel	4	Automation experimental stands utilization
Control devices used in automation of chemical processes. First order and second order proportional elements. Experimental assessment using hydraulic system	4	Use of acquisition data software (Mas-View) and control device software (Sys-config) for monitoring and controlling chemical processes.
Control devices used in automation of chemical processes. Second order and superior proportional elements. Experimental study on dynamic behavior using heat exchanger	2	Experimental data handling and interpretation using Excel
Sensitive elements in automation of chemical processes. Experimental study on dynamic behavior of a thermos-resistive element	2	
Control of main parameters of chemical processes. Flow automated control. Transfer behavior of a sensitive element for flow measuring and of a pneumatic execution element	3	
Control of main parameters of chemical processes. Level automated control. Assessment of automated control quality	3	
Control of main parameters of chemical processes. Discontinuous temperature control	2	
Optimal adjustment of controllers. Labview applications	3	
Introduction to Simulink. Transfer functions. Dynamic behavior of a PI or PID controller	5	
Bibliography ¹⁴ 1. Delia Perju, Marcel Suta, Carmen Rusnac, Gabriela-Alina Brusturean, Automatizarea proceselor chimice. Aplicatii I, Timisoara: Politehnica, 2005. 2. Ștefan Ungureanu, Conducerea automata a proceselor : Teorie si aplicatii în ingineria chimica. Bucuresti : Matrix Rom, 2005. 3. Greg F. Shinsky, Process control systems, Application, desing, and Tuning, Boston: McGraw-Hill, 1996. 4. Abdalla Bsata, Instrumentation et automatisaion dans le controle des procedes, Canada: Le Griffon d Argile, 1994. 5. László Keviczky, Ruth Bars, Jenő Hetthéssy, Csilla Bányász, Control Engineering: MATLAB Exercises, Springer Nature Singapore Pte Ltd. 2019		

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.

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 syllabus is developed according to the requirements in the chemical/biochemical engineering field, being similar to other disciplines from Romanian universities and abroad.
- The syllabus was written considering the requirements and expectations of the employers in the field. These aspects were identified during discussions between Chemical Engineering Board members; the economic environment is well represented with distinguished representatives on this Board.
- The competencies acquired will be of great use for employes working in chemical plants, but also in research and development facilities, including design of chemical equipment

10. Evaluation

Type of activity	10.1 Evaluation criteria ¹⁵	10.2 Evaluation methods	10.3 Share of the final grade
10.4 Course	Knowledge of basics from the automation of chemical processes. Ability to apply the theoretical ideas in practice	Written and oral examination	0.5
10.5 Applied activities	S:		
	L: Degree of comprehension of the discussed topics. The degree of involvement in carrying out the experiment and data interpretation, the quality of presented reports.	Testing the knowledge in the automation field by discussing the proposed experiment, short quiz concerning experimental comprehension, experimental reports evaluation	0.5
	P¹⁶:		
	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)			
<ul style="list-style-type: none"> • Basic knowledge in automation in chemical industry; • Attendance at all laboratory sessions. 			

Date of completion

**Course coordinator
(signature)**

Prof.dr.ing. Gabriela -Alina DUMITREL

**Coordinator of applied activities
(signature)**

Ş.I. dr. ing. Ana-Maria PANĂ,
Ş.I.dr.ing. Valentin ORDODI

**Head of Department
(signature)**

S.L.dr.ing. Andra TĂMAŞ

Date of approval in the Faculty Council ¹⁸

**Dean
(signature)**

ŞL.dr.ing. Mircea Laurenţiu DAN

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.)

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.