Syllabus

1. Data about the program of study

1.1 Institution	Technical University of Cluj-Napoca
1.2 Faculty	Automation and Computer Science
1.3 Departament	Automation
1.4 Field of study	Systems Engineering
1.5 Cycle of study	Bachelor of Science
1.6 Program of study/Qualification	Automation and Applied Informatics (English)
1.7 Form of education	Full time
1.8 Subject code	48.00

2. Data about the subject

2.1 Subject name	***Continuous Plant Control***				
2.2 Course responsible/lecturer	Sl. Dr. ing. Ioana Naşcu – ioana.nascu@aut.utcluj.ro				
2.3 Teachers in charge of applications	Sl. Dr. ing. Ioana Naşcu – ioana.nascu@aut.utcluj.ro As.drd.ing. Mihai Stanese – mihai.stanese@aut.utcluj.ro Ing. Drd. Toderean Bianca - bianca.toderean@gmail.com				
2.4 Year of study	4	2.5 Semester	1	2.6 Assessment *(E/C/V)*	
2.7 Type of subject	Formative category *(DF – fundamental, DID – in the field, DS – specialty, DC – complementary)*				DS
	Optionality *(DI – compulsory, DO – elective, Dfac – optional)*				DI

3. Estimated total time

3.1 Number of hours per week	5	of which:	3.2 Course	2	3.3 Seminar	0	3.3 Laboratory	2	3.3 Project	1
3.4 Number of hours per semester	70	of which:	3.5 Course	28	3.6 Seminar	0	3.6 Laboratory	28	3.6 Project	14

3.7 Individual study	
(a) Manual, lecture material and notes, bibliography	20
(b) Supplementary study in the library, online and in the field	12
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays	12
(d) Tutoring	5
(e) Exams and tests	6
(f) Other activities:	0

3.8 Total hours of individual study (sum of (3.7(a)…3.7(f)))	55
3.9 Total hours per semester (3.4+3.8)	125
3.10 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 Curriculum	System theory, Process modeling , Control engineering, System identification, Electric and electronic control equipment
4.2 Competence	Systems theory, sensors and transducers, process modeling, control engineering, control instrumentation

5. Requirements (where appropriate)

5.1. For the course	The student needs to be present at 70% of the total number of lectures in order to have the right to take the exam.
5.2. For the applications	The student is allowed to participate to an application class only by presenting a report for the previous application.

6. Specific competences

6.1 Professional competences	• **C5 –** Development and implementation of automatic control structures and algorithms based on project management principles, software environments and

	technologies based on microcontrollers, signal processors, programmable logic controllers and embedded systems. ○ **C5.1 -** Identification of the concepts and methods for project management and of specific languages for application development(sequential, concurrent, real-time, non-real-time, distributed, embedded, non-embedded, mobile, on-line, etc.) ○ **C5.2 -** Explaining and interpreting the relation project-real system using the basic principles and methods of algorithms and automatic control structures design and implementation, including those of embedded or distributed systems built on microcontrollers, signal processors, programmable logic controllers, etc. ○ **C5.3 -** Selecting the technologies and the equipment appropriated for automatic systems, computer applications and operating conditions. ○ .**C5.4 -** Assessment of the implementation of automation and IT applications using automatic control structures, algorithms, programming environments and technologies based on microcontrollers, signal processors, programmable logic controllers, embedded systems, etc. ○ **C5.5 -** Transposing the results of the sizing computations in technical documents of the project, specific to applied informatics and automatic systems.
6.2 Cross competences	

7. Course objectives

7.1 General objective	Assimilation of knowledge on basic principles and functional design solutions of control systems for the main technological parameters of continuous processes.
7.2 Specific objectives	• Measurement of the main technological parameters of continuous processes, process identification and PID controller design • Implementation of the real-time process control system using PLC and DDC.

8. Contents

8.1. Lecture (syllabus)	No.hours	Teaching methods	Notes
C1. Defining the concept of continuous process, control systems structure.	2	Slides presentation, explanations and demonstrations on whiteboard, discussions	in cases of extreme situations, the courses will take place online on the Teams platform
C2. Standards, measurement units, graphic symbols. The characteristics of continuous industrial systems.	2		
C3. The design of continous control systems.	2		
C4. The design of digital control systems.	2		
C5. Case study.	2		
C6. Automatic control of the main technological parameters: the design of automatic control systems for thermal processes, temperature control in heat exchangers.	2		
C7. The design of pressure control systems.	2		
C8. The design of flow control systems.	2		
C9. The design of level control systems.	2		
C10. The control systems design for neutralization process, control system design for chemical reactors.	2		
C11. Advanced control structures: cascade control, feedforward control	2		
C12. Advanced control structures: selective control, ratio control, override control, split-range control, inferential control.	2		
C13. Plant wide control.	2		
C14. Case study.	2		
Bibliography 1. Essentials of process control, William Luyben, McGraw-Hill, 1997.			

2. Practical Process Control for Engineers and Technicians, Wolfgang Altmann, Elsevier, 2005
3. The control handbook, William Levine, CRC press, 1996,
4. Conducerea automată a proceselor industriale, M. Vînătoru., Craiova, 2001
5. Process Dynamicsand Control, D. Seborg et al. International Student Version, John Wiley 2011.
6. I. Naşcu, Sisteme de conducere a proceselor continue, material de curs în format electronic.

8.2**. Applications**	No.hours	Teaching methods	Notes
Laboratory		Implementing and testing the applications on the lab stands. Eexplanations and demonstrations on whiteboard, discussions.	in cases of extreme situations, will take place online on the Teams platform
L1. Programmable logic controllers - PLCs. Analog inputs/outputs, blocks for PID control	4		
L2. Temperature control of an electric soldering iron. Description, data acquisition, process identification, PID control with PLC.	4		
L3. Temperature control for ventilated air in a tube. Description, data acquisition, process identification, PID control with PLC.	4		
L4. Level control. Description, data acquisition, process identification, PID control with PLC.	4		
L5. Speed control for an electric motor. Description, data acquisition, process identification, PID control with PLC.	4		
L6. Advanced control structures for level control: cascade control, feedforward control.	4		
L7. Modeling and simulation of a continuous stirred tank reactor. Design and testing of control algorithms.	4		
Project			
L10. Mathematical modeling, model calibration, automatic control with pid, advanced control structures for a level control pilot plant.	14		

Bibliography
1. R. Crișan, I. Nașcu, Sisteme de conducere a proceselor continue, Indrumator de laborator, ISBN 978-973-662-794-1, Editura U.T. Press, 2013.
2. Ioan Nașcu, Gabriel Harja, Izabela Birs, Sisteme de conducere a proceselor continue - Indrumator de proiect, UTPRESS, 2015. ISBN 978-606-737-100-0.

9. Bridging course contents with the expectations of the representatives of the community, professional associations and employers in the field

Lectures and applications content was discussed with field experts. Over the years the course was favourably assessed by various rating agencies: National Council for Academic Evaluation and Accreditation, Romanian Agency for Quality Assurance in Higher Education.

10. Evaluation

Activity type	10.1 Assessment criteria	10.2 Assessment methods	10.3 Weight in the final grade
10.4 Course	theory, problems	Written exam / online exam using Teams	50%
10.5 Laboratory	individual work results	Practical assessment / online assesment using Teams	30%
10.5 Project	individual work results	Practical assessment / online assesment using Teams	20%
10.6 Minimum standard of performance: Synthesis of systems that controls the main values specific to continuous industrial processes.			

Date of filling in:		**Title Firstname NAME**	**Signature**
10.06.2024	Course	Conf. Ioana NAȘCU	
	Aplications	Conf. ing. Ioana Naşcu	
		As.drd.ing. Mihai Stanese	

Date of approval by the Department Board ……. _____	Head of Departament ..... Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty Council …… _____	Dean Prof.dr.ing.Mihaela DINȘOREANU