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 Codul disciplinei	32.00

2. Data about the subject

2.1 Subject name	***Control Engineering I***				
2.2 Course responsible/lecturer	Prof.dr.ing. DULF Eva-H. – Eva.Dulf@aut.utcluj.ro Prof.dr.ing. MURESAN Cristina – Cristina.Muresan@aut.utcluj.ro				
2.3 Teachers in charge of applications	As.dr.ing. BIRS Isabela – Isabela.Birs@aut.utcluj.ro Drd.ing. DANKU Alex– Alex.Danku@aut.utcluj.ro Ing. BERCIU Alexandru – Alexandru.Berciu@aut.utcluj.ro				
2.4 Year of study	3	2.5 Semester	3	2.6 Assessment *(E/C/V)*	E
2.7 Type of subject	*DF – fundamental, DD – in the field, DS – specialty, DC – complementary*				DD
	DI – compulsory, DO – elective, Dfac – optional				DI

3. Estimated total time

3.1 Number of hours per week	4	of which:	Course	2	Seminar	0	Laboratory	2	Project	0
3.2 Number of hours per semester	56	of which:	course	28	Seminar	0	Laboratory	28	Project	0
3.3 Individual study										
(a) Manual, lecture material and notes, bibliography										28
(b) Supplementary study in the library, online and in the field										10
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										28
(d) Tutoring										0
(e) Exams and tests										3
(f) Other activities:										0

3.4 Total hours of individual study (sum of (3.3(a)...3.3(f)))	69
3.5 Total hours per semester (3.2+3.4)	125
3.6 Number of credit points	5

4. Pre-requisites (where appropriate)

4.1 Curriculum	System theory I
4.2 Competence	Knowledge's gained after attending Mathematic general courses, Theoretical Basis for Automatic Systems , System Identification

5. Requirements (where appropriate)

5.1. For the course	Prior reading of the course slides
5.2. For the applications	Prior preparation of laboratory work

6. Specific competences

6.1 Professional competences	C3.1 Identification of basic concepts of system theory, control engineering, of fundamental principles of modeling and simulation, as well as of process analysis methods in order to explain the basic problems of the field. C3.2 Explaining and interpreting some process automation problems through the application of automatic control fundamentals, of modeling, identification and simulation methods as well as of the computer aided design techniques.

	C3.3 Solving some types of control problems through: use of modeling methods and principles, development simulation scenarios, application of methods for the identification and analysis of processes (including technological processes) and systems. C3.4 Performance evaluation of automatic systems, of the strengths and weaknesses of projects (SWOT analysis),and of the consistency of methods and theoretical foundations C3.5 Configuration and deployment of industrial process control, of robots and flexible manufacturing lines and choice of equipment, tuning and putting into service of related structures.
6.2 Cross competences	

7. Course objectives

7.1 General objective	Providing the graduates with sound engineering knowledge and broad professional skills to design, develop, implement,manage and supervise automation systems
7.2 Specific objectives	• To establish basic concepts of control engineering • Explanation and interpretation of control system's problems by applying the basics of automation • Solve some types of control problems • Performance evaluation of control systems • Configuration and implementation of process control systems

8. Contents

8.1 Lecture	No.hours	Teaching methods	Notes
Performance specifications of control system design	2	Lectures, systematic exposition, conversation, teaching demonstration, case study	In case of major force classes will be held online using Teams
Conventional and non-conventional structures	2		
Controller design using root locus method. The problem of correction	2		
Design of discontinuous (and cvasi-continuous) output controllers, on-off controller, step controller	2		
Frequency design methods based on second order equivalent system for PI, PD and PID controllers	2		
Quasi-optimum methods (Kessler's magnitude and symmetry)	2		
Frequency methods with imposed phase margin	2		
Theoretical Basis for experimental tuning methods (Offereins, Oppelt, Ziegler-Nichols)	2		
Controller design for dead time processes	2		
Cascade and feed – forward loop control design	2		
Decentralized control of MIMO systems	2		
Decoupled control of MIMO systems	2		
Multivariable systems MIMO description using transfer matrix. Controller matrix design	2		
Advanced control methods	2		

Bibliography
1. Dorf, R. C., Bishop, R. H., Modern Control Systems, Prentice Hall, 2008
2. Ogata, K., Modern Control Engineering, Prentice Hall, 2010
3. Astrom, K.J. Advanced PID control, Instrumentation, Systems, and Automation Society, 2006

8.2 Aplications (seminar/laboratory/project)	No.hours	Teaching methods	Notes
Steady –state error interpretation for control systems	2	Brainstorming, case study, conversation	In case of major force classes will be held
Performance measures of control systems	2		
Root locus design method	2		
Correction for root locus design method	2		
Frequency design methods. P and PI controller	2		

Frequency design methods. PD and PID controller	2		online using Teams
Quasi-optimum methods (Kessler's magnitude and symmetry)	2		
Frequency design methods with imposed phase margin	2		
Cascade loop control design	2		
Controller design using experimental design methods	2		
Controller implementation using PLC. Case studies	2		
Closed loop performance analysis according to PID parameter variation. Case study: ACS simulator	2		
Closed loop performance analysis according to PID parameter variation. Case study: speed and position control for a DC motor	2		
Closed loop performance analysis according to PID parameter variation. Case study: twin rotor aerodynamical system	2		
Bibliography 1. Ogata, K., Matlab for Control Engineers, Prentice Hall, 2007 2. Grace, A., Control system Toolbox : for use with MATLAB : user's guide, Math Works, 1995 3. Dulf E.H., Muresan C.I., Control Engineering 1, Laboratory guide – electronic version			

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

The content of the discipline was discussed with the representatives of the prestigious companies in Romania, Europe and the United States of America and was repeatedly evaluated by the Romanian Government Agencies (CNEAA, ARACIS)

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	Acquired knowledge Course activity	Written exam / online exam using Teams	60%
Seminar	-	-	
Laboratory	Acquired practical skills, Laboratory activity	Practical assessment / online assessment using Teams	40%
Project	-	-	
Minimum standard of performance: Exam grade>5, Laboratory grade>5			

Date of filling in:		Title Firstname NAME	Signature
10.03.2022	Course	Prof. Dr. eng. Eva DULF Prof.dr.eng. Cristina MURESAN	
	Aplications	Asist. Dr. Eng. Eng. Isabela BIRS	
		Drd.ing. Alex DANKU	
		Ing. Alexandru BERCIU	

Date of approval by the Department Board of Automation ________________________	Head of Departament of Automation Prof.dr.ing. Honoriu VĂLEAN
Date of approval by the Faculty Council of Automation and Computer Science ________________________	Dean Prof.dr.ing. Liviu Cristian MICLEA