SYLLABUS

1. Program Data

1.1	Higher Education Institution	Technical University of Cluj-Napoca
1.2	Faculty	Faculty of Electrical Engineering
1.3	Departamentul	Electrotechnics and Measurements
1.4	Field of study	Electrical Engineering
1.5	Cycle of studies	Bachelor of Science
1.6	Study Program / Qualification	Electrical System Cluj-Napoca in English language
1.7	Form of education	Full time
1.8	Discipline Code	29

2. Course Data

2.1 Name of the discipline	Control System Engineering					
2.2 Course holder	*Sl.dr.ing. SZOKE Eniko, eniko.szoke@emd.utcluj.ro* *Sl.dr.ing SALCU Sorin Ionut, sorin.salcu@emd.utcluj.ro*					
2.3 Holder of seminar / laboratory / project activities	*Sl.dr.ing SALCU Sorin Ionut, sorin.salcu@emd.utcluj.ro* *Sl.dr.ing. SZOKE Eniko, eniko.szoke@emd.utcluj.ro*					
2.4 Year of study	I	2.5 Semesterl	1	2.6 Type of assessment		Review
2.7 Discipline regime	Educational category (*DF – fundamental, DD – Domain, DS – Specialty, DC – Complementary)*					DD
	DI – Mandatory, DO – optionala, DFac – optional					DI

3. Total estimated time

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

	3.7 Distribution of the time fund (hours per semester) for:	
	(a) Study by textbook, course material, bibliography and notes	20
	(b) Additional documentation in the library, on specialized electronic platforms and in the field	15
	(c) Preparation of laboratories, assignments, papers, portfolios and essays	15
	(d) Tutorial	2
	(e) Examinations	3
	(f) Other activities:	

3.8 Total hours of individual study *[Sum (3.7(a) through 3.7(f))]*		55
3.9 Total hours per semester *[sum between 3.4 and 3.8]*		125
3.10 Number of credits		5

4. Predictions (where applicable)

4.1 of curriculum	Theory of Electrical Circuits, Electronics, Mechanics, Programming, Mathematical Analysis, Special Mathematics
4.2 competencies	Real and Complex Variable Functions, Laplace Transform, Matrix Operations, Kirchoff's Theorems, Operational Amplifiers, C Programming

5. Conditions (whereapplicable)

5.1. course	Classroom with blackboard and multimedia projector

5.2. Seminar/ Laboratory	Seminar room and Laboratory with computer network and Matlab/Simulink

6. Specific competences acquired

Professional skills	C.6. Design of automatic control systems C6.1. Description of input-output and input-state-output representation methods using the fundamental elements of the mathematical theory of linear dynamical systems and the theory of automatic systems C6.2. Explanation and interpretation of classical tuning algorithms and modern tuning techniques C6.3. Application of analysis and synthesis methods specific to automatic, continuous and discrete control systems, in order to choose the appropriate components C6.4. Assessment of the quality, advantages and disadvantages of various automatic tuning methods, by applying time and frequency analysis methods for linear systems C6.5. Design of automatic control systems for electric drives using dedicated software
Transverse Compentences	CT 1. Identification of the objectives to be achieved, the available resources, the conditions for their completion, the work stages, the working times, the deadlines for achievement and the related risks. CT 2. Identifying roles and responsibilities in a multidisciplinary team and applying relationship techniques and effective work within the team CT 3. Efficient use of information sources and resources for communication and assisted professional training (Internet portals, applications)

7. Expected learning outcomes

Knowledge	The student/graduate identifies and describes basic concepts, principles, and methods in mathematics, physics, chemistry, technical drawing, economics, and computer science. The student/graduate explains and interprets theoretical and experimental results from mathematics, physics, chemistry, economics, technical drawing and computer science.
Abilities	The student/graduate operates with basic concepts, principles, and methods from fundamental disciplines. The student/graduate solves problems of mathematics, physics and chemistry with applicability in engineering and validates the solution obtained. The student/graduate performs engineering and economic calculations of medium complexity and associates them with graphic representations of letters or specific to computer-aided design. The student/graduate describes physico-chemical and economic phenomena and processes. The student/graduate applies evaluation criteria and methods for identifying, modeling, experimenting, analysis and qualitative and quantitative assessment of phenomena and processes specific to the fundamental field using digital technologies. The student/graduate acquires and processes data, interprets theoretical and experimental results. The student/graduate designs solutions, complying with relevant standards, for engineering problems of medium complexity that meet the specified needs, complying with public health, safety, welfare, environmental, sustainability and economic factors, as well as other specific constraints. The student/graduate develops technical drawings of execution and assembly in letter format or designed by computer aid. The student/graduate applies modern project management, economic and decision-making techniques including in a multidisciplinary setting.

Responsibility and autonomy	The student/graduate applies the values of ethics and deontology of the engineering profession. The student/graduate practices logical reasoning, evaluation and self-evaluation in decision-making. The student/graduate communicates effectively about engineering activities with a wide range of audiences. The student/graduate is engaged in lifelong learning for the acquisition and implementation of knowledge as needed using appropriate learning strategies. The student/graduate promotes dialogue, cooperation, respect for others and interculturality. The student/graduate works effectively as a member of the team or its leader.

8. Objectives of the discipline (reproducedfrom the grid of specific competences accumulated)

8.1 General objective of the discipline	• Understanding the concept of a system, and of the state of a system, • Mathematical model for a SISO LTI physical system • Analyze a system through model-based simulation • Understanding: negative reagent loop, control system, PID type regulator and an automatic system
8.2 Specific objectives	• Determination of the mathematical model for a physical system in the form of transfer function and/or equations of state • Analysis of the stability of a system (Routh-Hurwitz and Nyquist method) • Determining and analyzing the response of a system in the time and frequency domain • Use of design methods for control systems using: Root Locus and Bode, Nyquist Diagrams • Synthesis a regulation system using classical laws of type P, PI, PD, PID and interpret their response

9. Content

9.1 Curs		No. of hours	Teaching methods	Observe
1	Determination of the mathematical model for a physical system in the form of transfer function and/or equations of state	2	Presentation in PPT, video projector	
2	Analysis of the stability of a system (Routh-Hurwitz and Nyquist method)	2		
3	Determining and analyzing the response of a system in the time and frequency domain	2		
4	Use of design methods for control systems using: Root Locus and Bode, Nyquist Diagrams	2		
5	Synthesis a regulation system using classical laws of type P, PI, PD, PID and interpret their response	2		
6	Determination of the mathematical model for a physical system in the form of transfer function and/or equations of state	2		
7	Analysis of the stability of a system (Routh-Hurwitz and Nyquist method)	2		
8	Determining and analyzing the response of a system in the time and frequency domain	2		
9	Use of design methods for control systems using: Root Locus and Bode, Nyquist Diagrams	2		
10	Synthesis a regulation system using classical laws of type P, PI, PD, PID and interpret their response	2		
11	Determination of the mathematical model for a physical system in the form of transfer function and/or equations of state	2		

12	Analysis of the stability of a system (Routh-Hurwitz and Nyquist method)	2		
13	Determining and analyzing the response of a system in the time and frequency domain	2		
14	Use of design methods for control systems using: Root Locus and Bode, Nyquist Diagrams	2		

Bibliography

[1] Călin RUSU, Teoria si Controlul Sistemelor, note de curs 2016.
[2] Marius HANGANUT, Teoria Sistemelor Vol I si vol II Lito Universitatea Tehnica Cluj 1994
[3] K. OGATA, Modern Control Engineering 4rd Ed, Prentice Hall, 1999.
[4] B. C. KUO, Automatic Control Systems 7th ed, John Wiley, 1997
[5] Richard C. DORF, Robert H. BISHOP, Modern Control Systems, 11TH Ed. Prentice hall, 2001, New Jersey
[6] Călin RUSU , Programarea in Matlab a aplicatiilor cu Arduino, UTPress, 2019, ISBN 978-606-737-412-4, http://biblioteca.utcluj.ro/editura
[7] Digital control system design, Călin RUSU, Casa cartii de stiinta, 2000, 973-686-092-2, Cluj Napoca
[8] Ingineria robotilor : cinematica, dinamica si control, Călin RUSU, Mediamira, 2001, 973-9358-36-5, Cluj Napoca

9.2 Seminar/ Laboratory/ Project		No. of hours	Teaching Method	Observe
1	Laplace transform of common signals.	6	Problem Solving/ Modeling and simulation in dedicated environments: LabVIEW Matlab/Simulink/Control Toolbox/ SciLAB/XCOS	
2	Modeling of SISO systems. Transfer functions. Block diagrams, linearization of nonlinear systems.	6		
3	Modeling MIMO systems, state variables, equations of state.	6		
4	The response of the transitional regime. The response of the stable regime. Stability. Control systems. Classical Regulatory LawsP, PI, PD, PID.	6		
5	The place of roots in Matlab. Frequency response. Bode Diagrams.	6		
6	Stability, the Nyquist criterion. Dynamic compensation. PID compensator, lead, lag.	6		
7	Pole allocation method.	6		
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Bibliography

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2. Calin G RUSU, SZŐKE Enikő, KREISZER RADIAN Melinda – Matlab in modelarea simularea si controlul sistemelor. Ghid practic pentru studenti, Editura UT PRESS 2008,
3. Călin RUSU, Aplicatii Matlab in controlul sistemelor, Ed Mediamira, Cluj, 2006
4. Călin RUSU, Matlab in controlul sistemelor. Ghid practic pentru studenti si ingineri, Ed Mediamira, 2005

4. Matlab 7.1 Student version release 14 with Service Pack3, Matworks , www.matworks.com
5. Simulink 6.3 Student version release 14 with Service Pack3, Matworks 2005, www.matworks.com

6. Calin G. RUSU. – Teoria Sistemelor, note de curs, http://bavaria.utcluj.ro/~rcalin

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1. Control Tutorials for Matlab (internet) www.engin.umich.edu/group/ctm/index.html
2. Internet, www.matworks.com,
3. Motoare de cautare Google, Yahoo - www.google.com, www.yahoo.com
4. SCILAB/XCOS v5.5.2

10. Corroborationof the contents of the discipline with the expectations of the representatives of the epistemic community, professional associations and employers representative in the field related to the program

- understanding and systemic analysis of technical problems regardless of the field of application
- approaching analysis and design problems based on a systemic vision

11. Evaluare

Tip activitate	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final grade
10.4 Course	Knowledge and ability to creatively use acquired knowledge	Written exam	50%
10.5 Seminar / Laboratory / Project	Homework / Lab Assignment / Course Project	Individual activity evaluation	50%
10.6 Minimum performance standard Understanding of basic notions and terminology; Problem solving, Applying notions in practical situations.			

Data completării:	**Titular**	**Title First Name LAST NAME**	**Semnătura**
September 2025	Curs	Sl.dr.ing. Eniko Szoke Sl.dr.ing Sorin Ionuț SALCU	
	Aplicații (Seminar/ Laborator/ Proiect)	Sl.dr.ing Sorin Ionuț SALCU	
		Sl.dr.ing. Eniko Szoke	

Date of approval in the ETHM Department Council January 2026	**Head of Department:** Prof. Eng. MICU Dan Doru, PhD
Date of approval in the Faculty of Electrical Engineering Council February 2026	**Dean:** Assoc. Prof. Eng. CZIKER Andrei, PhD