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 Department	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	33.00

2. Data about the subject

2.1 Subject name	Dynamical Systems with Discrete Event				
2.2 Course responsible/lecturer	Prof. Adina Aștilean – adina.astilean@aut.utcluj.ro				
2.3 Teachers in charge of applications	Assoc. Prof. Camelia Avram – camelia.avram@aut.utcluj.ro Assist. Prof. Dan Radu – dan.radu@aut.utcluj.ro				
2.4 Year of study	3	2.5 Semester	5	2.6 Assessment *(E/C/V)*	E
2.7 Type of subject	*DF – fundamental, DD – in the field, DS – speciality, DC – complementary*				DD
	DI – compulsory, DO – elective, Dfac – optional				DI

3. Estimated total time

3.1 Number of hours per week	2	of which:	Course	2	Seminar		Laboratory	2	Project	
3.2 Number of hours per semester	56	of which:	course	28	Seminar		Laboratory	28	Project	
3.3 Individual study										
(a) Manual, lecture material and notes, bibliography										46
(b) Supplementary study in the library, online and in the field										12
(c) Preparation for seminars/laboratory works, homework, reports, portfolios, essays										6
(d) Tutoring										2
(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	Systems Theory Logic Design Process Modelling
4.2 Competence	Computer Programming

5. Requirements (where appropriate)

6. Specific competences

6.1 Professional competences	C3 Operating with fundamentals of control engineering, process modelling, simulation, identification and analysis methods. C5 Development and implementation of automatic control structures and algorithms based on project management principles, software environments and technologies based on programmable logic controllers

7. Course objectives

7.1 General objective	Understanding and applying formal methods for modelling, analysis, synthesis and control of discrete event systems
7.2 Specific objectives	• To use Petri net-based computer-aided tools, Grafcet method and flowcharts in modelling and control. • To develop advanced control techniques based on suitable formal models. • To use PLCs in discrete event systems control structures

8. Contents

8.1 Lecture	No. hours	Teaching methods	Notes
Introduction, approach methods, examples and applications of discrete event systems	2h	Modern and traditional methods	
Grafcet method-based approach of discrete event systems	2h		
Petri nets: formal definitions, transitions firing, incidence matrix, examples	2h		
Modelling features: Subclasses of Petri nets	2h		
Behavioural properties of Petri nets	2h		
Analysis methods of Petri nets	2h		
Deterministic timed Petri nets	2h		
Stochastic timed Petri nets; Markov chains	2h		
Modelling of flexible manufacturing systems based on Petri nets	4h		
Petri nets-based languages	2h		
Supervision methods of discrete event systems; algebraic approach	2h		
Foundation for the use of PLCs	4h		

Bibliography
1. Leţia, T., Aştilean, A., „Sisteme cu evenimente discrete”, Editura albastră, Cluj-Napoca,1998
2. Aştilean, A., Lecturer Notes, 2019
3. Desel, J., Esparz, J., Free Choice Petri Nets, Cambridge University Press, 2005
4. Stenerson, J., “Fundamentals of Programmable Logic Controllers, Sensors and Communications”, Prentice Hall, 2004
5. Pawlewsk, P., Petri Nets Applications, IntechOpen, 2010

8.2 Applications (seminar/laboratory/project)	No.hours	Teaching methods	Notes
Description and modelling of discrete event systems	2h	Interactive methods, examples, practical applications	Mandatory attendance
Grafcet method	2h		
Modelling of discrete event systems using Petri Nets; Simulation and analysis tools for Petri Nets	2h		
The evolution of the marking in Petri Nets	2h		
Behavioural properties of Petri Nets	2h		
Analysis Methods of Petri Nets	4h		
Timed Petri Nets-based modelling	2h		
Stochastic Petri Nets	2h		
Supervision of discrete event systems- Case studies	2h		
PLCs programming- basic notions	2h		
PLC-based process controls I	2h		
PLC-based process control II	2h		
Final test	2h		

Bibliography
1. Leţia, T., Aştilean, A., „Sisteme cu evenimente discrete”, Editura albastră, Cluj-Napoca,1998
2. Astilean, A., Lecturer Notes, 2021
3. Pawlewski, P., Petri Nets Applications, IntechOpen, 2010
4. Stenerson, J., “Fundamentals of Programmable Logic Controllers, Sensors and Communications”, Prentice Hall, 2004;
5. Laboratory eHandbook, 2018

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

The presented content is in accordance with actual orientations of the field

10. Evaluation

Activity type	Assessment criteria	Assessment methods	Weight in the final grade
Course	The capacity to use knowledge, creativity Correct utilisation of techniques or means of expression specific to the field	Written exam/ or online on Teams platform	0.8
Laboratory	Choices consistent with the objective and with the intent developed The development of relevant skills	Methods of checking homework Assessment of laboratory work	0.2
Project			
N=0.8E+ 0.2L Minimum standard of performance: E>=5; L>=5			

Date of filling in:		**Title First name NAME**	**Signature**
10.06.2024	Course	Prof. dr.ing. Adina AŞTILEAN	
	Applications	Assoc. Prof.dr.ing. Camelia AVRAM Asist. Prof. dr.ing. Dan RADU	

Date of approval by the Department Board

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Head of Department
Prof.dr.ing. Honoriu VĂLEAN

Date of approval by the Faculty Council

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Dean
Prof.dr.ing. Mihaela DÂNŞOREANU