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		Dyna	amical Systems with Discrete Event				
2.2 Course responsible/le	cture	r	Prof. Adina Aștilean – adina.astilean@aut.utcluj.ro				
2.3 Teachers in charge of	appli	cations	Assoc. Prof. Camelia Avram – <u>camelia.avram@aut.utcluj.ro</u> Assist. Prof. Dan Radu – <u>dan.radu@aut.utcluj.ro</u>				
2.4 Year of study	3	2.5 Semes	ter 5 2.6 Assessment (E/C/V)			Е	
2.7 Type of subject	DF –	fundament	amental, DD – in the field, DS – specialty, DC – complementary DI			DD	
2.7 Type of subject	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	56	of which:	course	28	Seminar		Laboratory	28	Project	
3.3 Individual study										
(a) Manual, lecture materia	l and r	notes, bibl	iography							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 modeling, 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 modeling 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		
Grafcet method-based approach of discrete event systems	2h		
Petri nets: formal definitions, transitions firing, incidence matrix, examples	2h		
Modeling features; Subclasses of Petri nets	2h		
Behavioral properties of Petri nets	2h		
Analysis methods of Petri nets	2h	Modern and	
Deterministic timed Petri nets	2h	traditional methods	
Stochastic timed Petri nets; Markov chains	2h		
Modeling 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		
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Bibliography

1. Leția, T., Aștilean, 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

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

Bibliography			
1. Leția, T., Aștilean, A., "Sisteme cu evenimente discrete", Editura	a albastră, Clu	ij-Napoca,1998	
2. Astilean, A., Lecturer Notes, 2021			
3. Pawlewski, P., Petri Nets Applications, IntechOpen, 2010			
4. Stenerson, J., "Fundamentals of Programmable Logic Controller	rs, Sensors an	d 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 utilization 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 if relevant skills	Methods of checking homework Assessment of laboratory work	0.2			
Project						
N=0.8E+ 0.2L						
Minimum standar	d of performance: E>=5; L>=5					

Date of filling in:		Title Firstname NAME	Signature
24.03.2023	Course	Prof. dr.ing.Adina Astilean	
	Applications	Assoc. Prof.dr.ing. Camelia Avram	
		Asist. Prof. dr.ing.Dan Radu	

 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. Liviu Cristian MICLEA