COURSE DESCRIPTION

1. Program Information

1.1 University	**Alexandru Ioan Cuza**
1.2 Faculty	**Faculty of Computer Science**
1.3 Department	**Computer Science**
1.4 Study Domain	**Computer Science**
1.5 Study Cycle	**Undergraduate studies**
1.6 Study Program / Qualification	Computer Science / Bachelor of Science

2. Course Information

2.1 Course Name			**Petri Nets and Applications**				
2.2 Course Teacher			**LECTURER OANA OTILIA CAPTARENCU, PHD**				
2.3 Seminary Teacher			**LECTURER OANA OTILIA CAPTARENCU , PHD**				
2.4 Study Year	**3**	**2.5** Semester	**2**	**2.6** Evaluation	**E**	**2.7** Course Status*	**OP**

** OB – Compulsory / OP – Optional*

3. Total estimated hours (hours per semester and didactic activities)

3.1 Hours per week	4	in which: **3.2** course	2	**3.3** seminary/laboratory	2
3.4 Hours in curriculum	56	in which: **3.5** course	28	**3.6** seminary/laboratory	28

Time Distribution	hours
Manual study, Course support, Bibliography, and others	**14**
Supplementary Documentation in library, in electronic forums, and on the field	**14**
Seminaries/laboratories preparation, homeworks, reports, portfolios and essays	**28**
Tutoring	**-**
Evaluation	**4**
Other activities (consultations per student)	**-**

3.7 Total hours individual study	**56**
3.8 Total hours per semester	**116**
3.9 Credits	**5**

4. Preconditions (if necessary)

4.1 Of Curriculum	
4.2 Of Skills	

5. Conditions (if necessary)

5.1 For Course Operation	
5.2 For Seminary/Laboratory Operation	

6. Specific Skills Acquired

Professional Skills	**C1.** The master and understanding of the basic concepts, theories and methods in the area of Petri nets **C2.** The use of the basic knowledge for the explanation and interpretation of certain situations and processes related to the domain (the use of different types of Petri nets for the modelling and analysis of real systems and processes).
Transversal Skills	**CT1.** The use of efficient methods and techniques to learn, reasearch and develope of the ability to employ efficiently the aquired knowledge

7. Course Objectives (from the grid of specific skills acquired)

7.1 General Objectives	- The definition of the basic principles and concepts in the area of Petri nets - The identification of the suitable models and methods for solving certain real problems
7.2 Specific Objectives	After attending this course, students should be able to: ▪ Describe real systems, using different classes of Petri nets ▪ Analyze properties of systems using Petri net based models ▪ Idenitify the most suitable class of Petri nets to model a given system ▪ Use software tools for editing and analyzing Petri nets

8. General Description

8.1	**Course**	**Teaching Methods**	**Observations** (hours and bibliographic references)
1.	Petri nets: introduction, properties	Exposure (video-projector)	References : 1, 2
2.	Behavioural properties of Petri Nets; Fundamental situations modeled with Petri nets; Capacity Petri nets	Exposure (video-projector)	References : 1, 2
3.	Analysis methods for Petri nets: covering structures	Exposure (video-projector)	References : 1, 2
4.	Linear Algebraic Techniques for analyzing properties of Petri nets.	Exposure (video-projector)	References : 1, 2
5.	Analiza structurala a retelelor Petri: tehnici bazate pe sifoane, capcane	Exposure (video-projector)	References : 2,3

6.	Applications of Petri nets in workflow theory: workflow nets	Exposure (video-projector)	References: 5
7.	Petri nets extensions	Exposure (video-projector)	References : 1, 2
8.	Summary of the analysis methods for Petri nets, case studies and applications	Exposure (video-projector), debate, case studies	References : 1, 2,3,5
9.	Time extensions of Petri nets	Exposure (video-projector)	References : 6, 7
10.	Time extensions of workflow nets	Exposure (video-projector)	References : 8
11.	Coloured Petri Nets: introduction	Exposure (video-projector)	References : 4
12.	Properties of Coloured Petri Nets	Exposure (video-projector), debate	References : 4
13.	Ierarhical Coloured Petri Nets	Exposure (video-projector), debate	References : 4
14.	Applications of Coloured Petri Nets	Exposure (video-projector), debate	References : 4

Bibliography

Main references:

1. T. Jucan, F.L. Tiplea: Retele Petri. Teorie si Practica. Romanian Academy Press, Bucuresti, 1999.
2. T. Murata. Petri nets: Properties, analysis and applications. Proc. of the IEEE 77(4), pp. 541-580, 1989.
3. W. Reisig. Elements of Distributed Algorithms. Modeling and Analysis with Petri Nets, Springer-Verlag, 1998.
4. K. Jensen. Coloured Petri Nets. Basic Concepts, Analysis Methods and Practical Use. Vol. 1, Basic Concepts. Monographs in Theoretical Computer Science, Springer-Verlag, 2nd corrected printing 1997. ISBN: 3-540-60943-1.
5. W.M.P. van der Aalst and K.M. van Hee. Workflow Management: Models, Methods, and Systems. MIT press, Cambridge, MA, 2004.
6. L. Popova, On Time Petri Nets, Journal of Information Processing and Cybernetics, vol. 27, no. 4, 227-244, 1991.
7. P.H. Starke, Some Properties of Timed Nets Under the Erliest firing rule, Advances in Petri Nets 1989, Lecture Notes in Computer Science, vol. 424, Springer-Verlag, 418-432, 1989.
8. F.L. T¸ iplea, G.I. Macovei, Timed Workflow Nets, Proceeding of the 7th Interational Symposium on Symbolic and Numeric Algorithms for Scientific Computing - SYNASC 2005, IEEE Computer Society, 361-366, 2005.

Supplementary references:

- Wil M. P. van der Aalst: Interval Timed Coloured Petri Nets and their Analysis. Application and Theory of Petri Nets 1993: 453-472

8.2	**Seminary / Laboratory**	**Teaching methods**	**Observations** (hours and bibliographic references)
1.	Description of systems using classic Petri nets. Finding properties of Petri nets.	Problem solving , debate	References : 1
2.	Description of systems using classic Petri nets and software tools (Tina 3.2)	Problem solving , debate	References : 1, 5

3.	Analysis of systems using Petri nets and covering structures	Problem solving	References: 1
4.	Analysis of systems using Petri nets and linear algebraic techniques	Problem solving , debate, case studies	References : 1
5.	Analysis of systems using Petri nets and linear algebraic techniques, structural analysis and software tools (Tina 3.2)	Problem solving , debate, case studies	References : 1, 5
6.	The modelling and analysis of soundness for workflows using workflow nets and workflow nets specific techniques	Problem solving , debate, case studies	References : 1
7.	The modelling and analysis of soundness for workflows using workflow nets and sotware tools (Tina 3.2, WoPeD)	Problem solving , debate, case studies	References: 1, 5,6
8.	The description and analysis of systems using Petri nets extenstions	Problem solving , debate, case studies	References : 1
9.	Laboratory test: the description and analysis of systems using Petri nets and specific software tools (Tina)	Problem solving , debate, case studies	
10.	Applications of Time Petri Nets and Timed Petri Nets. The use of Tina 3.2 for editing and analyzing time Petri nets	Problem solving , debate, case studies	References : 1, 5
11.	Coloured Petri Nets: the use of CPN Tools for editing Coloured Petri Nets	Problem solving , debate, case studies	References : 1, 2,3,4
12.	The descriptions of systems using Coloured Petri Nets and CPN Tools	Problem solving , debate, case studies	References : 1, 2,3,4
13.	The descriptions of systems using Ierarhical Coloured Petri Nets and CPN Tools Descrierea unor sisteme utilizand retele Petri colorate ierarhice si CPN Tools	Problem solving , debate, case studies	References : 1, 2,3,4
14.	Projects presentation (systems modelled with Coloured Petri Nets and CPN Tools)		

Bibliography

1. Courese bibliography
2. K. Jensen and L.M. Kristensen. *Coloured Petri Nets -- Modeling and Validation of Concurrent Systems*. Springer-Verlag Berlin, 2009.
3. A.V. Ratzer, L. Wells, H.M. Lassen, M. Laursen, J.F. Qvortrup, M.S. Stissing, M. Westergaard, S. Christensen, and K. Jensen. *CPN Tools for Editing, Simulating, and Analysing Coloured Petri Nets*. LNCS 2679, pp. 450-462, Springer-Verlag Berlin, 2003
4. CPN Tools home page http://cpntools.org/
5. Tina home page: http: http://projects.laas.fr/tina//download.php
6. WoPeD home page: http://www.woped.org/

9. Course content synchronization with the expectations of the community representatives, professional associations and employers from the program domain

10. Evaluation

Activity Type	**10.1 Evaluation criteria**	**10.2 Evaluation methods**	**10.3 The weight of each evaluation form (%)**
10.4 Course	Two written tests, T1 and T2, graded from 1 to 10. The sum of grades for the two tests should be at least 8.	Written tests T1 (week 8) and T2 (examination session)	T1 – 40% T2- 20%
10.5 Seminary/ Laboratory	Laboratory activity (LSA) is grades from 0 to 10. The grade for LSA should be at least 5.	LSA is obtained by problem solving during laboratories (20% LSA), a laboratory test (50% LSA) and a project (30% LSA)	40%
10.6 Minimal performance standards			
- The understanding of the basic concepts and principles in the Petri net area. - The modelling and solving of problems with a moderate degree of complexity, using computer science and mathematics knowledge (the modelling and analyzing of a system, using simulation tools and learned techniques)			

Date Course Teacher Seminary/Laboratory Teacher

Department Date of Approval Director of the Department