SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babes-Bolyai University**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Department of Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Master**
1.6 Study programme / Qualification	**Software Engineering**

2. Information regarding the discipline

2.1 Name of the discipline	**Computational Models for Embedded Systems**						
2.2 Course coordinator	**PhD Lecturer Andreea Vescan**						
2.3 Seminar coordinator	**PhD Lecturer Andreea Vescan**						
2.4. Year of study	**2**	2.5 Semester	**4**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**compulsory**

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar/laboratory	1
3.4 Total hours in the curriculum	36	Of which: 3.5 course	24	3.6 seminar/laboratory	12

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	72
Additional documentation (in libraries, on electronic platforms, field documentation)	24
Preparation for seminars/labs, homework, papers, portfolios and essays	36
Tutorship	3
Evaluations	4
Other activities:	0

3.7 Total individual study hours	139
3.8 Total hours per semester	175
3.9 Number of ECTS credits	7

4. Prerequisites (if necessary)

4.1. curriculum	
4.2. competencies	

5. Conditions (if necessary)

5.1. for the course	Video projector, Internet access
5.2. for the seminar /lab activities	Laboratory with computers; model checking tools; LabView; FSM/PN tools.

6. Specific competencies acquired

Professional competencies	• Assimilation of mathematical concepts and formal models to understand, verify and validate software systems; • Analysis, design, and implementation of software systems • Proficient use of methodologies and tools specific to programming languages and software systems • Organization of software production processes.
Transversal competencies	• Etic and fair behavior, committment to professional deontology • Team work capabilities; able to fulfill different roles • Professional communication skills; concise and precise description, both oral and written, of professional results , negociation abilities; • Antepreneurial skills; working with economical knowledge; continuous learning • Good English communication skills.

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• know and understand fundamental concepts of embedded computation; • to develop skills in modeling embedded systems with various computational models; • to describe and verify safety and liveness properties of the system being modeled.
7.2 Specific objective of the discipline	• will acquire theoretical aspects regarding specification, designing and verification of an embedded system; • will acquire theoretical aspects regarding various computational models for embedded systems; • will know how to model a system and specify restrictions on functionalities.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction. Model: Why?what? how? Types of systems.	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
2. Synchronous models.	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
3. Asynchronous models	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
4. Requirements and Safety Requirements. Model checking	• Interactive exposure • Explanation	

	• Conversation • Didactical demonstration	
5. LabView	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
6. Finite State Machines	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
7. Finite State Machines (cont.)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
8. Petri Nets	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
9. Petri Nets (cont.)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
10. Dynamical systems	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
11. Timed Models	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
12. Hybrid systems	• Interactive exposure • Explanation • Conversation • Didactical demonstration	

Bibliography

[1] C. Baier, J.-P. Katoen, Principles of Model Checking, ISBN 978-0-262-02649-9, 2008
[2] M. Ben-Ari, Principles of the Spin Model Checker, ISBN 978-1-84628-769-5
[3] Taylor Booth (1967) Sequential Machines and Automata Theory, John Wiley and Sons, New York. Library of Congress Catalog Card Number: 67-25924.
[4] D. Harel, "Statecharts: A Visual Formalism for Complex Systems", Sci. Comput. Programming 8 (1987), 231-274
[5] Petri, CA (1966) Communication with automata. DTIC Research Report AD0630125
[6] Hoare, CAR (2004) (1985), Communicating Sequential Processes, Prentice Hall International

Optional references Internet resources and conferences		
8.2 Seminar / laboratory	Teaching methods	Remarks
		The seminar is structured as 2 hours classes every second week.
		The attendance at seminars is 75% compulsory (4 of 6).
Lab 1 (Report Paper Activity, weeks 1-2) Choose Report theme.	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	
Lab 2 (MC Project Activity, weeks 3-4) Specifying safety and liveness requirements. Model checking.	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	
Lab 3 (LabView, weeks 5-6) LabView -NI myRIO - The Ultimate Student Design Tool	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	
Lab 4 (FSM/PN Project Activity, weeks 7-8) Using Finite State Machines or/and PetriNets to model an embedded system.	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	Delivery date for Report Paper Activity
Lab 5 (FSM/PN Project Activity weeks 9-10) Using Finite State Machines or/and PetriNets to model an embedded system.	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	Delivery date for the Model Checking Project Activity
Lab 6 (weeks 11-12) Delivery for Seminar Activities (Report Paper, Model Checking Project Activity, FSM/PN Project Activity)	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	Delivery date for the FSM/PN Project Activity

Bibliography

- Students will search and use computational models for embedded systems documentation on the web, using main CS databases - for the Report Paper Activity.
- Students will search and use model cheking tools suitable for their Model Checking Project Activity. http://spinroot.com/spin/whatispin.html
- Students will search and use FSM/PN tools suitable for their FSM/PN Project Activity.

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- This course follows the IEEE and ACM Curriculla Recommendations for Computer Science studies;

• The course exists in the studying program of all major universities in Romania and abroad; http://www.seas.upenn.edu/~cis540/ https://inst.eecs.berkeley.edu/~ee249/fa07/ http://www.ict.kth.se/courses/IL2202/ http://users.abo.fi/lmorel/MoCs/ http://bears.ece.ucsb.edu/class/ece253/ • Course content is considered very important by the software companies for improving advance embedded systems modeling and verifying skills.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	• The correctness and completeness of the accumulated knowledge of computational models for embedded systems.	Written exam (in the regular session)	60%
10.5 Seminar/lab activities	• Class attendance	2 unmotivated absences are accepted, but each unmotivated absence other than those specified above are penalized.	10%
	• A theoretical research report on a computational model for embedded system topic should be prepared.	Resume - paper content: subject, relevance of the paper, results reported, conclusion.	10%
	• Problem definition and specification in JSpin, Show that it is possible to reach the desired end state	Evaluation of the project (modeling, verification properties)	10%
	• Use Finite State Machine or Petri Nets to model the embedded system.	Evaluation of the project (modeling, I/O, computational model used)	10%
10.6 Minimum performance standards			
• Each student has to prove that: o (s)he acquired an acceptable level of knowledge and understanding of the computational models for embedded systems; o (s)he has the ability to establish certain connections and to use the knowledge in solving different problems. • Successful passing of the exam is conditioned by the final grade that has to be at least 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
30.04.2014	Lect. PhD. Andreea Vescan	Lect. PhD. Andreea Vescan

Date of approval

Signature of the head of department

Prof. PhD. Bazil Pârv