

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	Artificial Intelligence for Connected Industries

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)	Embedded Systems: Applications and Cybersecurity - Computational Models for Embedded Systems Sisteme embedded: Aplicatii si Securitate cibernetica - Modele computationale pentru sisteme embedded						
2.2 Course coordinator	PhD Associate Professor Andreea Vescan						
2.3 Seminar coordinator	PhD Associate Professor Andreea Vescan						
2.4. Year of study	2	2.5 Semester	3	2.6. Type of evaluation	E	2.7 Type of discipline	Optional
2.8 Code of the discipline	MME8245						

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar/laboratory	2
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar/laboratory	28
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					87
Additional documentation (in libraries, on electronic platforms, field documentation)					14
Preparation for seminars/labs, homework, papers, portfolios and essays					14
Tutorship					2
Evaluations					2
Other activities:					0
3.7 Total individual study hours	119				
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	<ul style="list-style-type: none"> • Video projector, Internet access
5.2. for the seminar /lab activities	<ul style="list-style-type: none"> • Laboratory with computers; model checking tools; LabView; FSM/PN tools.

6. Specific competencies acquired

Professional competencies	<ul style="list-style-type: none"> • 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 <p>Organization of software production processes.</p>
Transversal competencies	<ul style="list-style-type: none"> • Eitic and fair behavior, commitment 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, negotiation abilities; • Entrepreneurial skills; working with economical knowledge; continuous learning <p>Good English communication skills.</p>

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

7.1 General objective of the discipline	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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
Lectures content and schedule are tentative (will be modified according to the needs identified in class).		
1. Introduction. Model: Why? What? How? Types of systems. Requirements and Safety Requirements.	Interactive exposure Explanation, Conversation Didactical demonstration	
2. Model checking	Interactive exposure Explanation, Conversation Didactical demonstration	
3. Model checking	Interactive exposure Explanation, Conversation Didactical demonstration	
4. Synchronous models	Interactive exposure	

5. Asynchronous models.	Explanation,Conversation Didactical demonstration	
6. Automotive Invited Lecture	Interactive exposure Explanation,Conversation Didactical demonstration	
7. Automotive Invited Lecture	Interactive exposure Explanation,Conversation Didactical demonstration	
8. Finite State Machines (1)+(2)	Interactive exposure Explanation,Conversation Didactical demonstration	
9. IoT + Real time: Operating systems for Embedded systems Scheduling and real-time operating systems Build system for automated embedded and IoT software production	Interactive exposure Explanation,Conversation Didactical demonstration	
10. Petri nets	Interactive exposure Explanation,Conversation Didactical demonstration	
11. Timed models	Interactive exposure Explanation,Conversation Didactical demonstration	
12. Hybrid systems	Interactive exposure Explanation,Conversation Didactical demonstration	
13. Dynamical systems	Interactive exposure Explanation,Conversation Didactical demonstration	
14. Research report presentation by students	Interactive exposure Explanation,Conversation Didactical demonstration	

Bibliography

Books

- [Kat08] C. Baier, J.-P. Katoen, Principles of Model Checking, ISBN 978-0-262-02649-9, 2008
[Ari08] M. Ben-Ari, Principles of the Spin Model Checker, ISBN 978-1-84628-769-5, 2008
[Noe05] T. Noergaard, Embedded systems architecture: a comprehensive guide to engineers and programmers, Elsevier, 2005
[Hoar04] Hoare, CAR (2004) (1985), Communicating Sequential Processes, Prentice Hall International
[Pon02] M. Pont, Embedded C, Addison-Wesley, 2002
[Boo67] Taylor Booth (1967) Sequential Machines and Automata Theory, John Wiley and Sons, New York. Library of Congress Catalog Card Number: 67-25924.

Articles

- [Har87] D. Harel, "Statecharts: A Visual Formalism for Complex Systems", Sci. Comput. Programming 8 (1987), 231-274
[Pet66] Petri, CA (1966) Communication with automata. DTIC Research Report AD0630125

Tutorials

During lectures/seminars/laboratories tutorials will be given for each assignment.

8.2 Seminar / laboratory	Teaching methods	Remarks
Seminar content and schedule are tentative (will be modified according to the needs identified in class).		
Seminar 1, 2, 3	Presentation, Conversation,	

<ul style="list-style-type: none"> • Model Cheking • Specifying safety and liveness requirements. 	Problematizations, Discovery, Individual study, Exercises	
Seminar 4, 5, 6 <ul style="list-style-type: none"> • Finite State Machines Project Activity • Using Finite State Machines or/and PetriNets to model an embedded system 	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	
Seminar 7 <ul style="list-style-type: none"> • Delivery of projects (not delivered in Seminar 3 or Seminar 6) 	Presentation, Conversation, Problematizations, Discovery, Individual study, Exercises	
Remark: <ul style="list-style-type: none"> • Students will search and use model cheking tools suitable for their Model Checking Project Activity. http://spinroot.com/spin/whatispin.html • Students will use LPCXpresso for developing FSM –based embedded project • Students will search and use FSM/PN tools suitable for their FSM/PN Project Activity. Bibliography See from Courses content.		

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

<ul style="list-style-type: none"> • This course follows the IEEE and ACM Curricula Recommendations for Computer Science studies; • The course exists in the studying program of all major universities in Romania and abroad; <ul style="list-style-type: none"> 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.
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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)	50%
10.5 Seminar/lab activities	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 to model the embedded system.	Evaluation of the project (modeling, I/O, computational model used)	10%
	Research report on embedded system.	Evaluation of the research report (documentation+presentation)	30%
	Students will have the possibility of obtaining bonus points at the final grade for additional activities that are related to Software systems verification and validation:	Bonus points	Bonus points at the final grade (after obtaining the final minimum required grade 5).

	conduction research/report and various activities during lectures.		
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Remark evaluation: Research Paper on a topic related to Embedded systems as extra credit for evaluation.

Remark .

- Seminar/Laboratory assignments/Projects laboratory work may not be redone in the retake session.
- Written exams can be taken during the retake session.
- Students from Previous Years to current academic year
 - All the above rules apply to students from previous years.
 - Seminar/Laboratory assignments and practical laboratory activity must be redone during didactic activity time (in the 14 weeks before normal session).
- The final grade computed with the given formula must be at least 5 in order to pass the exam.
 Final grade = 50% WrittenExan+10%ProjectJSpin+10%ProjectFSM+30%Report

10.6 Minimum performance standards

Each student has to prove that:

- (s)he acquired an acceptable level of knowledge and understanding of the computational models for embedded systems;
- (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

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Assoc. Prof. PhD. Andreea Vescan,

Assoc. Prof. PhD. Andreea Vescan

Date of approval

Signature of the head of department

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Assoc. Prof. PhD. Sterca Adrian