SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-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	High Performance Computing and Big Data Analytics

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			Formal modelling of concurrent processes / Modelarea formala a proceselor concurente				
2.2 Course coordinator			Lect. Phd. Adrian Sterca				
2.3 Seminar coordinator			Lect. Phd. Adrian Sterca				
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**
2.8 Code of the discipline		MME8094					

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	1 sem + 1 pr
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					20
Additional documentation (in libraries, on electronic platforms, field documentation)					19
Preparation for seminars/labs, homework, papers, portfolios and essays					40
Tutorship					20
Evaluations					20
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	• Distributed operating systems, Concurrent and distributed programming
4.2. competencies	• Concurrent and distributed programming

5. Conditions (if necessary)

5.1. for the course	• Class room with a video projector device
5.2. for the seminar /lab activities	•

6. Specific competencies acquired

Professional competencies	Mathematical tools for modelling concurrent systems
Transversal competencies	The ability to mathematically model local or distributed transactional systems The ability to mathematically model and analyse concurrent process systems

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

7.1 General objective of the discipline	• The course offers a strong theoretical approach in modelling concurrent and distributed systems
7.2 Specific objective of the discipline	• The course presents several formalisms for describing concurrent processes

8. Content

8.1 Course	Teaching methods	Remarks
1. Serialization, concurrency and parallelism	Exposure:description, explanation,examples, discussion of case studies	
2. Concurrent programming paradigms: shared memory, message passing, transactional memory	Exposure:description, explanation,examples, discussion of case studies	
3. Concurrency models for transactional systems. The Page Model. The Object model	Exposure:description, explanation,examples, discussion of case studies	
4. Concurrency control – serializability criteria (Page Model)	Exposure:description, explanation,examples, discussion of case	

	studies	
5. Concurrency control – serializability criteria (Page Model)	Exposure:description, explanation,examples, discussion of case studies	
6. Concurrency control algorithms (Page Model)	Exposure:description, explanation,examples, discussion of case studies	
7. Multiversioning data	Exposure:description, explanation,examples, discussion of case studies	
8. Concurrency control – serializability criteria and algorithms (Object Model)	Exposure:description, explanation,examples, discussion of case studies	
9. Failure recovery	Exposure:description, explanation,examples, discussion of case studies	
10. Concurrency control in distributed context	Exposure:description, explanation,examples, discussion of case studies	
11. Process algebra I	Exposure:description, explanation,examples, discussion of case studies	
12. Process algebra II	Exposure:description, explanation,examples, discussion of case studies	
13. CCS – Calculus of Communicating Systems	Exposure:description, explanation,examples, discussion of case studies	
14. Pi-Calculus	Exposure:description, explanation,examples, discussion of case studies	

Bibliography

1. Weikum G. Vossen G. Transactional Information System: Theory, Algorithms, and Practice of Concurrency Control and Recovery. Kaufmann Morgan Publ. 2002.
2. Reichel H. Formal Models of Concurrency, 2003
3. Robin Milner, Communication and Concurrency, Prentice Hall, International Series in Computer Science, ISBN 0-13-115007-3. 1989
4. Bertran Meyer, Concepts of concurrent computations, course, 2015
5. Robert Milner, A Calculus of Communicating Systems, Springer, 1986
6. Luca Aceto, Anna Ingolfsdottir, Kim G. Larsen, Jiri Srba, Reactive Systems: Modelling, Specification and Verification, 2005.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Discussions related to the project or report's subject	Dialog, debate, case studies, examples	
2. Discussions related to the project or report's subject	Dialog, debate, case studies, examples	
3. Discussions related to the project or report's subject	Dialog, debate, case studies, examples	
4. Report presentations	Dialog, debate, case studies, examples	
5. Report presentations	Dialog, debate, case studies, examples	
6. Project presentations	Dialog, debate, case studies, examples	
7. Project presentations	Dialog, debate, case studies, examples	
Bibliography Recent articles from ACM Digital Library and IEEE Xplore		

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

- The course respects the IEEE and ACM Curriculla Recommendations for Computer Science studies;
- The course's contents is in the curiculla of major universities from abroad for master programs

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowing the formalisms for describing concurrency presented during the course	Examination	30%
10.5 Seminar/lab activities	Ability to understand recent research and relate it to theoretical concepts presented at the course	Project Research report	40% 30%
10.6 Minimum performance standards			
➢ In order to successfully pass this course, students must get at least 5 at each of the 3 examination tasks.			

Date	Signature of course coordinator	Signature of seminar coordinator
.....	Lect.PhD. Adrian Sterca	Lect.PhD. Adrian Sterca

Date of approval	Signature of the head of department
.....	Prof. PhD. Anca Andreica