SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University of Cluj-Napoca**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Doctoral School in Mathematics and Computer Science**
1.4 Field of study	**Computer Science**
1.5 Study cycle	**Doctoral studies**
1.6 Study programme	**TRAINING PROGRAM BASED ON ADVANCED ACADEMIC STUDIES**

2. Information regarding the discipline

2.1 Name of the discipline	**Search-based Software Engineering**						
2.2 Course coordinator	**Prof. PhD Czibula Istvan**						
2.3 Seminar coordinator	**Prof. PhD Czibula Istvan**						
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**C**	2.7 Type of discipline	**Optional**

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 sem
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	40
Additional documentation (in libraries, on electronic platforms, field documentation)	72
Preparation for seminars/labs, homework, papers, portfolios and essays	73
Tutorship	13
Evaluations	16
Other activities:	-

3.7 Total individual study hours	214
3.8 Total hours per semester	250
3.9 Number of ECTS credits	10

4. Prerequisites (if necessary)

4.1. curriculum	Software Engineering, Artificial intelligence
4.2. competencies	Good programming skills

5. Conditions (if necessary)

5.1. for the course	
5.2. for the seminar /lab activities	Laboratory with computers; high level programming language environment (.NET or any Java environment a.s.o.)

6. Specific competencies acquired

Professional competencies	• Advanced ability to approach, model and solve phenomena and problems from nature and economy using fundamental knowledge from mathematics and computer science. • Ability to approach and solve complex problems using various techniques of computational intelligence. • Proficient use of methodologies and tools specific to programming languages and software systems.
Transversal competencies	• Ethic and fair behaviour, 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 • Good English communication skills

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

7.1 General objective of the discipline	● To present the field of Search Based Software Engineering as a new research and application domain of software engineering.
7.2 Specific objective of the discipline	● To introduce the student a new field of Software Engineering- Search Based Software Engineering. ● To induce the necessity and importance of using computational intelligence techniques for solving software engineering problems. ● To present some important activities within software engineering and how are they solved using computational intelligence techniques.

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction ● Search Based Software Engineering ● Main concepts and approached problems	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
2. Machine learning in Software Engineering ▪ Machine learning techniques ▪ Applications	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
3. CI techniques for Program Comprehension	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
4. CI techniques for Refactoring	● Interactive exposure	

	● Explanation ● Conversation ● Didactical demonstration	
5. CI techniques for Defect Detection and prediction	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
6. CI techniques for Software Testing	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
7. CI techniques for Software Vizualization	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
8. CI techniques for Effort prediction and Cost estimation	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
9. CI techniques for Software Reuse	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
10. CI techniques for Design Patterns identification	● Interactive exposure ● Explanation ● Conversation ● Didactical demonstration	
11. SBSE research reports presentation	● Interactive exposure ● Conversation	
12. SBSE research reports presentation	● Interactive exposure ● Conversation	

Bibliography

1. Czibula, I., G., Use of search techniques to software development, Editura Risoprint, ISBN 978-973-53-0119-4, 2009 (248 pagini)
2. Mark Harman and Bryan F. Jones. Search-based software engineering. Information & Software Technology, 43(14):833-839, 2001.
3. Olaf Seng, Johannes Stammel, and David Burkhart. Search-based determination of refactorings for improving the class structure of object-oriented systems. In GECCO '06: Proceedings of the 8th annual conference on Genetic and evolutionary computation, pages 1909{1916, New York, NY, USA, 2006. ACM Press.
4. Frank Simon, Frank Steinbruckner, and Claus Lewerentz. Metrics based refactoring. In CSMR '01: Proceedings of the Fifth European Conference on Software Maintenance and Reengineering, pages 30-38, Washington, DC, USA, 2001. IEEE Computer Society.

8.2 Seminar / laboratory	Teaching methods	Remarks
		The seminar is structured as 2 hours

		classes every second week
1. Survey of the sources of information available on Internet and Intranet; chosing the paper topic and scheduling the presentation.	• Documentation • Explanation • Conversation	
2-4. *Presentation of theoretical research reports*. Each PhD student will have to prepare and present a theoretical research report. The report will present the current state-of-the-art in the field of a selected SBSE topic .	• Presentation • Explanation • Conversation	
5-7. *Presentation of a software project*. Each PhD student will have to prepare and present a software project on the SBSE topic chosen at the theoretical report.	• Presentation • Explanation • Conversation	

Bibliography

1. Czibula, I., G., Use of search techniques to software development, Editura Risoprint, ISBN 978-973-53-0119-4, 2009 (248 pagini)
2. Mark Harman and Bryan F. Jones. Search-based software engineering. Information & Software Technology, 43(14):833-839, 2001.
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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 content of the discipline is consistent with the similar disciplines from other PhD programs from romanian universities and universities from abroad.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4-5 Course	• A theoretical research report on a SBSE topic based on some recent research papers should be prepared and presented	Evaluation of the research report (a written paper of about 10 pages and an oral presentation)	50%
	• A software project on a SBSE topic will be fully implementied, without using existing frameworks	Evaluation of the experimental report (documentation and demonstration)	50%
10.6 Minimum performance standards			
• Each PhD student has to prove that (s)he acquired an acceptable level of knowledge and understanding of the SBSE domain, that (s)he is capable of stating these knowledge in a coherent form, that (s)he has the ability to establish certain connections and to use the knowledge in solving different problems.			

Date	Signature of course coordinator	Signature of seminar coordinator
30.06.2021	Prof. dr. Istvan Gergely Czibula	Prof. dr. Istvan Gergely Czibula

Date of approval	Signature of the head of doctoral school
07.07.2021	Prof. dr. Gabriela Czibula