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	**Undergraduate**
1.6 Study programme / Qualification	**Artificial Intelligence**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Fundamental algorithms** **Algoritmi fundamentali**				
2.2 Course coordinator			**Prof. dr. Camelia Chira**				
2.3 Seminar coordinator			**Prof. dr. Camelia Chira**				
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		MLE5200					

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

3.1 Hours per week	6	Of which: 3.2 course	2	3.3 seminar/laboratory	2 sem 2 lab
3.4 Total hours in the curriculum	84	Of which: 3.5 course	28	3.6 seminar/laboratory	56

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	14
Additional documentation (in libraries, on electronic platforms, field documentation)	12
Preparation for seminars/labs, homework, papers, portfolios and essays	14
Tutorship	8
Evaluations	18
Other activities:	

3.7 Total individual study hours	66
3.8 Total hours per semester	150
3.9 Number of ECTS credits	6

4. Prerequisites (if necessary)

4.1. curriculum	•
4.2. competencies	•

5. Conditions (if necessary)

5.1. for the course	-
5.2. for the seminar /lab activities	-

6. Specific competencies acquired

Professional competencies	C1.1 Definition and description of programming paradigms and of language specific mechanisms, as well as identification of syntactic and semantic differences. C1.2 Description of existing software applications, on different levels of abstraction (architecture, classes, methods) using adequate basic knowledge. C1.3 Elaboration of adequate source code and testing of components in a well-known programming language, based on given specifications. C1.4 Testing applications based on testing plans. C1.5 Development of units of programs and corresponding documentation
Transversal competencies	TC1 Application of efficient and rigorous working rules, manifest responsible attitudes towards the scientific and didactic fields, underlying the individual potential and respecting professional and ethical principles. TC3 Use of efficient methods and techniques for learning, information, research and development of abilities for knowledge exploitation, for adapting to the needs of a dynamic society and for communication in a widely used foreign language.

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

7.1 General objective of the discipline	• To introduce the basic concepts of software engineering (design, implementation and maintenance) and to learn Python programming language
7.2 Specific objective of the discipline	• To introduce the key concepts of programming • To introduce the basic concepts of software engineering • To gain understanding of basic software tools used in development of programs • To learn Python programming language and tools to develop, run, test and debug programs • To acquire and improve a programming style according to the best practical recommendations

8. Content

8.1 Course	Teaching methods	Remarks
1. Introduction to software development processes • What is programming: algorithm, program, basic elements of the Python language, Python interpreter, basic roles in software engineering • How to write programs: problem statement, requirements, feature driven development process • Example: calculator	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
2. Procedural programming • Compound types: list, tuple, dictionary	• Interactive exposure • Explanation	

• Functions: test cases, definition, variable scope, calling, parameter passing • Test-driven development (TDD), refactoring	• Conversation • Examples • Didactical demonstration	
3. Modular programming • What is a module: Python module definition, variable scope in a module, packages, standard module libraries, deployment • Eclipse + PyDev	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
4. User defined types • How to define new data types: encapsulation, data hiding in Python, guidelines • Introduction to object-oriented programming • Exceptions	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
5. Software design guidelines • Layered architecture: UI layer, application layer, domain layer, infrastructure layer • How to organize source code: responsibilities, single responsibility principle, separation of concerns, dependency, coupling, cohesion	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
6. Object-oriented programming • UML diagrans • Implementation of classes in Python • Objects and classes: classes, objects, fields, methods, Python scope and namespace	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
7. Design aspects • Top down and bottom up strategies • UI elements	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
8. Program testing and inspection • Testing methods: exhaustive testing, black box testing, white box testing • Automated testing, TDD • File operations in Python	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
9. Recursion • Notion of recursion • Direct and indirect recursion • Examples • Computational complexity	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
10. Search algorithms • Problem definition • Search methods: sequential, binary • Complexity of algorithms **Sorting algorithms** • Problem definition	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	

• Sort methods: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort • Complexity of algorithms		
11. Backtracking • General presentation of the method • Algorithms and complexity • Examples	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
12. Divide et impera, Greedy • General presentation of the methods • Algorithms and complexity • Examples	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
13. Dynamic programming • Method description • Examples	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
14. **Revision**		

Bibliography

1. M. Frentiu, H.F. Pop, Fundamentals of Programming, Cluj University Press, 2006.
2. K. Beck, Test Driven Development: By Example. Addison-Wesley Longman, 2002. http://en.wikipedia.org/wiki/Test-driven_development
3. M. Fowler, Refactoring. Improving the Design of Existing Code, Addison-Wesley, 1999. http://refactoring.com/catalog/index.html
4. The Python Programming Language - https://www.python.org/
5. The Python Standard Library - https://docs.python.org/3/library/index.html
6. The Python Tutorial - https://docs.python.org/3/tutorial/

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Simple Python programs	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
2. Procedural Programming		
3. Modular Programming		
4. Feature-driven software development		
5. Abstract data types		
6. Design principles		
7. Object-oriented programming		
8. Program design. Layered architecture		
9. Inspection and testing		
10. Recursion. Complexity of algorithms		
11. Search and sorting algorithms		
12. Problem solving methods: Backtracking		
13. Problem solving methods: Greedy		
14. Practical test		

Bibliography

1. M.L. Hetland, Beginning Python: From Novice to Professional, Apress, 2005.
2. M. Frentiu, H.F. Pop, Fundamentals of Programming, Cluj University Press, 2006.
3. K. Beck, Test Driven Development: By Example. Addison-Wesley Longman, 2002. http://en.wikipedia.org/wiki/Test-driven_development
4. M. Fowler, Refactoring. Improving the Design of Existing Code, Addison-Wesley, 1999. http://refactoring.com/catalog/index.html

5. The Python Programming Language - https://www.python.org/
6. The Python Standard Library - https://docs.python.org/3/library/index.html
7. The Python Tutorial - https://docs.python.org/3/tutorial/

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 Curricula Recommendations for Computer Science studies.
- The course exists in the studying program of all major universities in Romania and abroad.
- The content of the course is considered by the software companies as important for average programming 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 and the capacity to design and implement correct Python programs	Written exam	40%
10.5 Seminar/lab activities	Be able to design, implement and test a Python program	Practical exam	30%
	Correctness of laboratory assignments and documentation delivered during the semester	Program and documentation	30%
10.6 Minimum performance standards			
➢ Each student must demonstrate an acceptable level of knowledge and understanding of the domain, the ability to present knowledge in a coherent manner and the ability to establish connections and use this knowledge to solve different problems in Python. ➢ It is mandatory for each student to attend minimum 10 seminars and 12 labs. ➢ A minimum grade of 5 should be obtained at the lab activity, practical test and written examination.			

Date	Signature of course coordinator	Signature of seminar coordinator
26.04.2023	Prof. univ. dr. Camelia Chira	Prof. univ. dr. Camelia Chira

Date of approval

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Signature of the head of department

Prof. dr. Laura Dioşan