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	**Informatics**
1.5 Study cycle	**Bachelor**
1.6 Study programme / Qualification	**Artificial Intelligence**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Object Oriented Programming** **Programare orientată obiect**				
2.2 Course coordinator			**Lect. PhD Diana Laura Borza**				
2.3 Seminar coordinator			**Lect. PhD Diana Laura Borza**				
2.4. Year of study	**1**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**
2.8 Code of the discipline		**MLE5006**					

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

3.1 Hours per week	5	Of which: 3.2 course	2	3.3 seminar/laboratory	1 sem 2 lab
3.4 Total hours in the curriculum	70	Of which: 3.5 course	28	3.6 seminar/laboratory	42

Time allotment:	hours
Learning using manual, course support, bibliography, course notes	15
Additional documentation (in libraries, on electronic platforms, field documentation)	10
Preparation for seminars/labs, homework, papers, portfolios and essays	15
Tutorship	4
Evaluations	11
Other activities:	

3.7 Total individual study hours	55
3.8 Total hours per semester	125
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	• Fundamentals of programming
4.2. competencies	• Average programming skills in a high-level programming language

5. Conditions (if necessary)

5.1. for the course	• Class room with projector
5.2. for the seminar /lab activities	• Laboratory with computers, having a C++ compiler, a C++ IDE (preferably Visual Studio) and Qt library installed

6. Specific competencies acquired

Professional competencies	• C3.1 Identifying classes of problems and solving methods that are specific to computing systems • C3.2 Using interdisciplinary knowledge, solution patterns and tools, making experiments and interpreting their results • C3.3 Applying solution patterns using specific engineering tools and methods • C3.4 Comparative and experimental evaluation of the alternative solutions for performance optimization • C3.5 Developing and implementing information system solutions for concrete problems
Transversal competencies	• CT1 Honorable, responsible, ethical behavior, in the spirit of the law, to ensure the professional reputation • CT3 Demonstrating initiative and proactive behavior for updating professional, economical and organizational culture knowledge

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

7.1 General objective of the discipline	• To understand the concepts of the object-oriented programming paradigm and to design object-oriented solutions of small/medium scale problems, using C++ and Qt.
7.2 Specific objective of the discipline	• To demonstrate the differences between traditional imperative design and object-oriented design. • To explain class structures as fundamental, modular building blocks. • To understand the role of inheritance, polymorphism, dynamic binding and generic structures in building reusable code. • To explain and to use defensive programming strategies, employing formal assertions and exception handling. • To design user- interfaces and write small/medium scale C++ programs using Qt. • To use classes written by other programmers and third-party libraries when constructing their systems.

8. Content

8.1 Course	Teaching methods	Remarks
1. **C/C++ introduction** (basic elements of C/C++ programming language, data types, constants, variables, scope and lifetime of the variables, statements, functions: declaration and definition, overloading functions).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	

2. **Modular programming in C/C++** (functions, formal and actual parameters, pointers and memory management, the stack and the help, pointers to functions, header files, modular programming, libraries).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
3. **Object oriented programming in C++** (introduction to object oriented programming, object oriented programming features, abstraction, encapsulation, classes and objects, access modifiers, object creation and destruction, operator overloading, static and friend elements).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
4. **Inheritance and polymorphism** (base and derived classes, Liskov substitution principle, method overriding, inheritance and polymorphism).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
5. **Polymorphism** (static and dynamic binding, virtual methods, multiple inheritance, upcasting and downcasting, abstract classes, UML class diagrams and relations).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
6. **Templates in C++. The C++ Standard Template Library** (function templates, class templates, containers in STL: array, vector, list, stack, heap, map, set), iterators, STL algorithms, lambda functions.	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
7. **Streams and exception handling** (input output streams, insertion and extraction operators, overloading insertion and extraction operators, formatting, manipulators, flags, text files, exception handling, exception safe code).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
8. **Resource management and RAII** (Resource Acquisition Is Initialization (RAII), smart pointers, move semantics, smart pointers in STL: std::unique_ptr, std::shared_ptr, std::weak_ptr)	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
9. **Graphical User Interfaces** (Qt Toolkit: installation, Qt modules and instruments, Qt GUI components, Layout management, design interfaces using Qt Designer).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
10. **Event driven programming I** (callbacks, events, signals and slots in Qt).	• Interactive exposure • Explanation • Conversation • Examples	

	• Didactical demonstration	
11. **Event driven programming II** (Model View Controller, Models and Views in Qt, using predefined models, implementing custom models).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
12. **Design patterns I** (creational, structural, behavioral patterns, examples, singleton, factory method, adapter pattern).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
13. **Design patterns II** (façade pattern, observer pattern, strategy pattern, case study application and examples).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	
14. **Revision** (revision of the most important topics covered by the course, examination guide).	• Interactive exposure • Explanation • Conversation • Examples • Didactical demonstration	

Bibliography

1. B. Stroustrup. ***The C++ Programming Language***, Addison Wesley, 1998.
2. Bruce Eckel. ***Thinking in C++***, Prentice Hall, 1995.
3. A. Alexandrescu. ***Programarea moderna in C++: Programare generica si modele de proiectare aplicate***, Editura Teora, 2002.
4. S. Meyers. ***Effective C++: 55 Specific Ways to Improve Your Programs and Designs (3rd Edition)***, Addison-Wesley, 2005.
5. S. Meyers. More effective C++: 35 New Ways to Improve Your Programs and Designs, Addison-Wesley, 1995.
6. B. Stroustrup. ***A Tour of C++,*** Addison-Wesley, 2013.
7. C++ reference (http://en.cppreference.com/w/).
8. Qt Documentation (http://doc.qt.io/qt-5/).
9. E. Gamma, R. Helm, R. Johnson, J. Vlissides. ***Design Patterns: Elements of Reusable Object-Oriented Software***, Addison-Wesley Longman Publishing, 1995.

8.2 Seminar	Teaching methods	Remarks
1. Simple problems in C. Functions. Structures, enums and arrays.	• Interactive exposure • Explanation • Conversation	The seminar is structured as a 2 hour class, every 2 weeks.
2. Modular programming.	• Interactive exposure • Explanation • Conversation	
3. Classes. Operator overloading. User-defined objects as class data members.	• Interactive exposure • Explanation • Conversation	
4. Inheritance. Polymorphism. Templates.	• Interactive exposure • Explanation	

	• Conversation	
5. Files, exceptions. STL containers, iterators, algorithms.	• Interactive exposure • Explanation • Conversation	
6. Graphical User Interfaces.	• Interactive exposure • Explanation • Conversation	
7. Implementation based on UML diagrams. Design patterns.	• Interactive exposure • Explanation • Conversation	

Bibliography

1. B. Stroustrup. ***The C++ Programming Language***, Addison Wesley, 1998.
2. Bruce Eckel. ***Thinking in C++***, Prentice Hall, 1995.
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5. S. Meyers. More effective C++: 35 New Ways to Improve Your Programs and Designs, Addison-Wesley, 1995.
6. B. Stroustrup. ***A Tour of C++,*** Addison-Wesley, 2013.
7. C++ reference (http://en.cppreference.com/w/).
8. Qt Documentation (http://doc.qt.io/qt-5/).
9. E. Gamma, R. Helm, R. Johnson, J. Vlissides. ***Design Patterns: Elements of Reusable Object-Oriented Software***, Addison-Wesley Longman Publishing, 1995.

8.3 Laboratory	Teaching methods	Remarks
1. Environment setup (installing a C++ compiler and an IDE). C/C++ basics.	• Explanation • Conversation	The laboratory is structured as weekly 2 hour classes.
2. Introductory problems (in C).	• Explanation • Conversation	
3. Feature-driven software development process. Layered architecture. Test driven development. Modular programming	• Explanation • Conversation	
4. Classes and objects in C++. Copy constructors, assignment operators, destructors.	• Explanation • Conversation	
5. Inheritance. Method overriding.	• Explanation • Conversation	
6. Inheritance and polymorphism. Virtual methods.	• Explanation • Conversation	
7. Laboratory test.	Practical test	
8. STL containers, iterators and algorithms.	• Explanation • Conversation	
9. Streams, overloading the insertion and extraction operators, persistence.	• Explanation • Conversation	
10. Exception handling. Testing.	• Explanation • Conversation	
11. Qt Graphical User Interfaces I.	• Explanation • Conversation	

12. Qt Graphical User Interfaces II. Signals and slots in Qt.	• Explanation • Conversation	
13. Design patterns.	• Explanation • Conversation	
14. Laboratory test.	Practical test	

Bibliography

1. B. Stroustrup. ***The C++ Programming Language***, Addison Wesley, 1998.
2. R. Gilberg. **C++ Programming: An Object-Oriented Approach**, McGraw-Hill Education, 2019
3. A. Alexandrescu. ***Programarea moderna in C++: Programare generica si modele de proiectare aplicate***, Editura Teora, 2002.
4. S. Meyers. ***Effective C++: 55 Specific Ways to Improve Your Programs and Designs (3rd Edition)***, Addison-Wesley, 2005.
6. B. Stroustrup. ***A Tour of C++,*** Addison-Wesley, 2013.
7. C++ reference (http://en.cppreference.com/w/).
8. Qt Documentation (http://doc.qt.io/qt-5/).
9. E. Gamma, R. Helm, R. Johnson, J. Vlissides. ***Design Patterns: Elements of Reusable Object-Oriented Software***, Addison-Wesley Longman Publishing, 1995.
10. Bruce Eckel. ***Thinking in C++***, Prentice Hall, 1995.

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 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 object-oriented 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 C++ programs.	Written examination (regular session).	**60%**
10.5 Seminar/lab activities	Ability to design, implement, test and debug	Practical evaluation. Two tests during the semester.	**20%**

	a C++ program with a graphical user interface.		
	Project.	Design, implementation and testing of a small-medium application that uses a 3-tier architecture. Documentation	**20%**

10.6 Minimum performance standards

- Students must prove that they acquired an acceptable level of knowledge and understanding of the core concepts taught in the class, that they are capable of using this knowledge in a coherent form, that they have the ability to establish certain connections and to use the knowledge in solving small/medium scale problems using object-oriented programming in C++.
- Successfully passing the examination is conditioned by a minimum grade of 5 (no rounding) for the laboratory practical test, the laboratory assignment and written examination.
- Attendance is mandatory for 5 seminar sessions and 12 laboratory sessions.

Date	Signature of course coordinator	Signature of seminar coordinator
02.10.2024	Lect. PhD. Diana Laura Borza	Lect. PhD. Diana Laura Borza

Date of approval

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Signature of the head of department

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