PhD Physics course at Bari University (XXXI Cycle)

Title	Fundamentals in advanced programming
Proponent	Francesco Cafagna
# CFU **(1 CFU = 8 hours)**	4
Schedule	Between September or October
Brief Summary of the course	This course, focuses on an introduction to the fundamental concepts founding the evolution from procedural to object-oriented programming. The C++ programming language will be used as a case study for such an evolution; for this the language base grammar, along with the base functionalities that better adhere to the object-oriented paradigm, will be treated. Lesson plan foresees a number of exercises, tuned to deepen the theoretical argument treated in each session.
Programme	**Lesson 1 and 2.** **Course introduction and layout:** - From procedural programming languages to the object oriented ones. - Programming: an introduction. - Programming: base concepts. - Programming: the jargon. - Basic introduction to the tools and techniques used to build an executable. **Lesson 3 and 4.** - An object oriented programming language: C++. **The C++ base grammar:** - Base types. - Expressions and statements. - Functions. - Pointer and reference. - Examples and exercise. **Lesson 5 and 6.** **C++ advanced functionalities:** - Aggregate types: Structure and Union. - Function overloading. - Namespaces. - Template programming. - Examples and exercises.

	Lesson 7. **Class:** - **An introduction and general properties.** - **Class members: creator, destructors, methods and helper functions.** - **Manage access to the class members: public, private.** - **Operators and overloading.** - **Examples and exercises.** **Lesson 8 and 9.** **Class advanced functionalities:** - **Derived class.** - **Inheritance and polymorphism.** - **Examples and exercises.** **Lesson 10.** **The Standard Template Library: STL.** - **An introduction and general properties.** - **In-depth view of the STL objects used in the course: string, containers, functionals and algorithms.** **Hints on Object Oriented programming: some example of popular structural patterns.**
Recommended texts	- Lecture slides and examples. - B. Stroustrup, The C++ programming language (Third edition), Addison – Wesley - B. Stroustrup, Programming -- Principles and Practice Using C++, Addison -Wesley ISBN 978-0321543721. December 2008. - S. Oualline, Practical C++ Programming (Second Edition), O'Reilly - S. Meyer, Effective C++ Third Edition, Addison-Wesley ISBN-13: 978-0321334879 - D. Vandevoorde & N.M. Josuttis, C++ Templates – The complete Guide, Addison-Wesley ISBN-13: 978-0201734843 - H. Sutter, Exceptional C++: 47 engineering Puzzles, Programming Problems and Solutions. Reading, MA: Addison-Wesley.
Assessment methods	A presentation and discussion on an exercise proposed by the student. The exercise should possibly be related to the student research project, and use techniques, functionalities and tools threated during the course.