Scientific computing with C++ - course description

General information

Course name	Scientific computing with C++
Course ID	13.2-WF-FizD-SCC++-S21
Faculty	Faculty of Physics and Astronomy
Field of study	Physics
Education profile	academic
Level of studies	Second-cycle studies leading to MS degree
Beginning semester	winter term 2021/2022

Course information

Semester	1
ECTS credits to win	6
Available in specialities	Computer Physics
Course type	obligatory
Teaching language	english
Author of syllabus	• dr Marcin Kośmider

Classes forms

The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Laboratory	45	3	-	-	Credit with grade
Lecture	15	1	-	-	Exam

Aim of the course

The aim of the course is to learn how to create software in C ++ using modern software development techniques and C ++ libraries. The contents of the laboratories are related to simulations, modeling and data analysis

Prerequisites

Knowledge of structural and object-oriented programming in any programming language.

Scope

I. Introduction to C++

1. Variables, data types, static typing, type convertion, compilation, naming conventions
2. Mathematical and logical operators, conditional statement and operator
3. Loops
4. Functions
5. Arrays
6. Pointers and references
7. Memory management

II. Introduction to OOP in C++

1. Classes, objects, methods
2. STL Container - string, vector, map
3. IO operations
4. Errors and Exceptions

III Developing classes and functions for selected scientific computations and simulations

1. Search algorithms
2. Sorting algorithms
3. Monte Carlo algorithms
4. Numerical integration algorithms
5. Least square methods
6. Matrix operations

Teaching methods

Lecture, laboratory exercises, project method, group work, ideas exchange, brainstorming, presentation, work with documentation, self-learning

Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
The student is able to develop a proposed problem in the form of a project, submit a report on the implementation of the project in written and oral form.		• a preparation of a project • a project • activity during the classes	• Laboratory
The student is able to discuss the characteristic features and way of working with libraries learned during laboratory classes and used to write a semester project.		• an exam - oral, descriptive, test and other	• Lecture
The student is able to work in a group		• activity during the classes • an ongoing monitoring during classes	• Laboratory
The student is able to write a program for numerical solution of the presented physics problem with the use of appropriate libraries.		• a project • activity during the classes • an ongoing monitoring during classes	• Laboratory
The student is able to independently search for libraries helpful in solving physics problems, read their documentation and use them, in accordance with the license entries, to solve a given problem		• a project • activity during the classes • an ongoing monitoring during classes	• Laboratory
The student is able to discuss how to create an IT project and propose techniques and tools to facilitate its implementation.		• an exam - oral, descriptive, test and other	• Lecture

Assignment conditions

Laboratory: Minimum 50% of test points (total), semester project. Evaluation from the laboratory: 50% test rating, 50% project evaluation. Lecture: exam Final mark: 70% laboratory, 30% exam grade

Recommended reading

1. Thinking in C++, Bruce Eckel - wydanie angielskie online

2. "Wprowadzenie do C++. Efektywne nauczanie. Wydanie III", C.Hortsman, Helion

3. "Opus magnum C++ 11. Programowanie w języku C++. Wydanie II poprawione", J.Grębosz, Helion

4. "C++17 STL Cookbook" J.Galowicz, Helion

Further reading

Internet

Notes

Modified by dr Marcin Kośmider (last modification: 10-05-2021 22:22)