

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	PHYSICS DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	506	SEMESTER	7
COURSE TITLE	Object-Oriented Programming Languages (C++)		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>	WEEKLY TEACHING HOURS	CREDITS	
	4	5	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	skills development		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/enrol/users.php?id=882		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B*
- *Guidelines for writing Learning Outcomes*

This course provides students with introductory knowledge of object-oriented programming, using the most widespread object-oriented programming language, C++. Special emphasis is given to open and free software, utilizing Linux as the operating system. In the second part of the course, the CERN ROOT data analysis software is used as an application of object-oriented principles. During lab exercises, students work on problem-solving directly on the computer. The course also offers the possibility to use the same development environment at home through a virtual machine (VirtualBox virtual appliance). Specifically, upon successful completion of the course, the student will be able to:

- Use the Linux operating system.
- Develop and compile programs in C++.
- Implement logic in their programs using control flow statements.
- Design complex object classes and enhance them with data management methods, applying the principles of object-oriented programming.
- Manage data files in their programs.
- Use the ROOT software interactively to create plots of functions with one or more

variables, 1-D and 2-D histograms, data graphs, and fit mathematical models to data.

- Use ROOT macro script files (in C++) to create plots of functions with one or more variables, 1-D and 2-D histograms, data graphs, and fit mathematical models to data.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology

Adapting to new situations

Decision-making

Working independently

Team work

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Showing social, professional and ethical responsibility and sensitivity to gender issues

Criticism and self-criticism

Production of free, creative and inductive thinking

.....

Others...

.....

Search for, analysis and synthesis of data and information, with the use of the necessary technology.

Adapting to new situations

Working independently

Criticism and self-criticism

Production of free, creative and inductive thinking

(3) SYLLABUS

Principles of Object-Oriented Programming. Learning the C++ programming language. Introduction to the CERN data analysis software ROOT:

- Learning the C++ programming language in a Linux environment:
 - Managing folders and files
 - Basic C++ syntax
 - Input-output commands
 - Program flow control commands
 - Loops
 - Recursion
 - Objects
 - Functions
 - Classes
 - Inheritance
 - Polymorphism
- CERN ROOT software:
 - Function plots
 - 1-D and 2-D histograms
 - Data graphs
 - Fitting mathematical models to data

(4) TEACHING and LEARNING METHODS - EVALUATION

<p style="text-align: center;">DELIVERY <i>Face-to-face, Distance learning, etc.</i></p>	Face-to-face
<p style="text-align: center;">USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i></p>	<ul style="list-style-type: none"> • The course website is used for distributing lecture notes and posting announcements. • A Moodle platform is used for special exercises (VPL – Virtual Programming Lab). • Video projectors are used during both lectures and labs. • The lab component of the course is conducted exclusively using computers with the Linux operating system. • A virtual machine (VirtualBox OVA with Linux, C, C++, Python, ROOT, etc.) is provided for installation on students' personal computers for practice.

<p style="text-align: center;">TEACHING METHODS <i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i></p> <p><i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></p>	Activity	Semester workload
	Lectures (Theory - Examples)	26
	Lab Exercises	26
	Study and analysis of bibliography	45
	Exams	3
	Course total	100

<p style="text-align: center;">STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i></p> <p><i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	<p>Laboratory performance (30%) Students develop programs on a weekly basis. The development of these programs is done exclusively using a computer.</p> <p>Written Exam (70%) A written exam is held at the end of the course, which includes program development based on the material taught or/and tests during the course (with multiple choice questions, short answer questions, etc.).</p> <p>A passing grade in the laboratory component, as described in the course regulations, is a prerequisite for participating in the final exams.</p>
---	--

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

- *Related academic journals:*

- "C++: From Theory to Application"
G. Tselikis, ISBN: 9786188676213, GEORGIOS TSELIKIS, 2023
- "SCHAUM'S Programming with C++"
John R. Hubbard, ISBN: 9789604611270, KLEIDARITHMOS, 2008
- "Programming with C++, 2nd Edition"
Bjarne Stroustrup, ISBN: 9789604911141, A. PAPASOTIRIOU & CO. I.K.E., 2018
- "The C++ Programming Language"
Bjarne Stroustrup, ISBN: 9789606454646, KLEIDARITHMOS, 2023
- "C++, 9th Edition"
Walter Savitch, ISBN: 9789604184996, A. TZIOLA & SONS PUBLISHING CO., 2015
- Links on the course website to resources for software development in C++ and to installation/user manuals for CERN's ROOT software.