COURSE OUTLINE

1. GENERAL

SCHOOL			
DEPARTMENT	DEPARTMENT OF PHYSICS UNDEGRADUATE STUDY PROGRAM: PHYSICS		
LEVEL OF STUDIES	ISCED level 6 – Bachelor's or equivalent level		
COURSE CODE	Y204-2023	**SEMESTER**	2nd Semester
COURSE TITLE	Algorithms and Computers Programming		

TEACHING ACTIVITIES If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
	4	6.0

COURSETYPE Background, General Knowledge, Scientific Area, Skill Development	Background
PREREQUISITES	None
TEACHING & EXAMINATION LANGUAGE:	Greek
COURSE OFFERED TO ERASMUS STUDENTS:	YES
COURSE URL:	https://eclass.emt.duth.gr/courses/PHYSICS159/

2. LEARNING OUTCOMES

Learning Outcomes Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.
The student who succeeds in this course will have understood the logic behind how to solve basic programming problems by selecting the appropriate algorithm in each case. They will be able to approach a problem by breaking it down into the necessary analytical steps, using pseudocode and/or flowcharts. They will then program each individual smaller part and integrate them to solve the overall problem. This course aims to develop digital skills, the ability to analyze problems, collaborative problem-solving strategies, and the ability to search for and utilize relevant information from the internet. It also offers students a first taste of an entire branch of Physics: Computational Physics.

General Skills

Name the desirable general skills upon successful completion of the module

Search, analysis and synthesis of data and information,
ICT Use,Adaptation to new situations,
Decision making,
Autonomous work,
Teamwork,
Working in an international environment,
Working in an interdisciplinary environment, Production of new research ideas
Project design and management
Equity and Inclusion
Respect for the natural environment
Sustainability
Demonstration of social, professional and moral responsibility and sensitivity to gender issues
Critical thinking
Promoting free, creative and inductive reasoning

Search, analysis and synthesis of data and information, ICT Use
Adaptation to new situations
Decision making
Autonomous work
Teamwork
Working in an interdisciplinary environment
Promoting free, creative and inductive reasoning

3. COURSE CONTENT

The course aims to teach fundamental concepts related to the logic and use of algorithms, as well as introduce students to basic programming principles. The programming language chosen for this course is Python. Students are expected to understand why it is important to use algorithms in solving programming problems and to be able to choose the appropriate algorithm for each situation. In addition, they will learn only the basic programming commands, while take-home assignments will be used to encourage further independent learning.

Specifically, for the Algorithms section:

- Definition of algorithms. Rules of algorithm design.
- Fundamental concepts of algorithm efficiency analysis. Notation: O, Ω, and Θ.
- Algorithms for:
  - Sorting
  - Searching
  - String manipulation
  - Graph problems
  - Combinatorial problems
  - Geometric problems
  - Numerical problems
- Fundamental algorithmic techniques:
  - Brute force and exhaustive search
  - Decrease and conquer
  - Divide and conquer
  - Transform and conquer
  - Greedy method
  - Dynamic programming
  - Backtracking
  - Branch and bound
  - Recursive algorithms
- Graph algorithms
- The concept of pseudocode

The concept of flowcharts, the rules for creating them, and their practical use
Examples demonstrating how pseudocode and flowcharts are used in problem solving

For the Programming section:
General introduction to Python and its programming environments
Introduction to operators and the syntax structure of Python code (e.g., indentation)
Sequential structure
Conditional structures (if / elif / else)
Looping structures using for
Looping structures using while
Data structures using lists
Data structures using tuples
Data structures using dictionaries
Functions
File handling

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD Face to face, Distance learning, etc.	Face to face
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) Use of ICT in Teaching, in Laboratory Education, in Communication with students	Use of ICT in Teaching Use of ICT in Laboratory Education Use of ICT in Communication with students
TEACHING ORGANIZATION The ways and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research& analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc. The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards	**Activity** / **Workload/semester** Lectures: 52 Tutoring: 26 Bibliographic research & analysis: 100 Total: **178**
STUDENT EVALUATION Description of the evaluation process Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others Please indicate all relevant information about the course assessment and how students are informed	**Student evaluation languages** Greek English **Method (Formative or Concluding)** Summative **Student evaluation methods** — **Rate** Written Exam with Problem Solving — 100

5. Suggested Bibliography

Εισαγωγή στον Υπολογισμό και τον Προγραμματισμό με την Python, 3η έκδοση, Guttag John V.
Python - Προγραμματισμός για Επιστήμες Υπολογιστών και Δεδομένων, Lin Johnny Wei-Bing, Aizenman Hannah, Espinel Erin Manette Cartas, Gunnerson Kim, Liu Joanne, Κατσαούνης Θεόδωρος (Επιστ. Επιμέλεια) PYTHON 3: ΑΛΓΟΡΙΘΜΙΚΗ ΚΑΙ ΠΡΟΓΡΑΜΜΑΤΙΣΜΟΣ, ΑΡΙΣΤΕΙΔΗΣ Σ. ΜΠΟΥΡΑΣ, ΓΙΑΝΝΗΣ Θ. ΚΑΠΠΟΣ
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Ανάλυση και Σχεδίαση Αλγορίθμων, 3η Έκδοση, Levitin Anavy, Μάνος Ρουμελιώτης (επιμέλεια)

Eudoxus

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