COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL of ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**EEE.5.1**	SEMESTER	5th
COURSE TITLE	Algorithms and Data Structures		
INDEPENDENT TEACHING ACTIVITIES *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*		WEEKLY TEACHING HOURS	CREDITS
	Lectures	4	5
	Lab Exercises	0	
	Total	4	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background Course (SBC)		
PREREQUISITE COURSES:	No		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eee.uniwa.gr/el/spoudes/proptyxiakes-spoudes/programma-spoudwn-5etes/programma-spoudon-ilektrologou-kai-ilektronikoy-mixanikoy-5etes		

(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*

The aim of this course is to teach basics of algorithms and data structures and their applied use for problem solving through coding in the C programming language.

Upon successful completion of this course, students are expected to be able to

1. Understand algorithms coded in C for the solution of (i) problems of simple math calculations, (ii) problems related to prime numbers and factorization, (iii) problems that require array sorting.
2. Modify given algorithms to improve their efficiency.
3. Calculate the complexity of a given algorithm.
4. Understand, explain and reproduce recursive algorithms for simple problems.
5. Convert iterative algorithms to recursive ones and compute their complexity.
6. Identify, describe and differentiate among key data structures (arrays, linear lists, trees, graphs).
7. Understand, explain and code the essential functions related to any one of the basic data structures taught (e.g., insert, delete, traverse, sort on a specific key, etc.)
8. Estimate the memory space requirements of alternative data structures employed in a given algorithm.
9. Select the appropriate data structure among alternatives, for a given problem, and code its functionalities in C; justify the choices made in terms of running time and memory requirements.

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Decision making
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

Major goals of the course are to familiarize students with the notions of data structures and data organization in the computer memory, the role of data structures in the design and coding of algorithms and to introduce them to the issues of algorithm performance / complexity as well as the scaling up for bigger data sets.

The course contents in brief :

- Algorithmic approach to problem solving, introduced by problems on (i) math calculations, (ii) prime numbers, (iii) sorting
- Complexity
- Iterative and recursive algorithms
- Static and dynamic data structures
- Linear data structures (arrays, lists, stacks, queues, heaps)
- Hierarchical data structures (trees, search trees, balanced trees)
- Graphs
- Hashing
- Digital inventories

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in class
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of ICT in teaching (e-class, presentations, notes) • Use of ICT in communication with students (e-class, e-mail) • Use of ICT in student homework assignments (C compiler)
TEACHING METHODS *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.* *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*	
STUDENT PERFORMANCE EVALUATION	I. Midterm exam (written) (optional, 50% or 30%): • multiple choice questions

Activity	*Semester workload*
Lectures	52
Study of lectures material	52
Problem solving for practice	26
Preparation for the exams	20
Course total	**150**

Description of the evaluation procedure *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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	• short-answer questions • problem solving and coding questions II. Homework assignments (optional, 20%): • problem solving and coding of the solution in C III. Final exam (written) (mandatory, 100% or 50%): • multiple choice questions • short-answer questions • problem solving and coding questions The material to be covered in the course and the exam is announced on the course e-class page, in the beginning of the semester. The exam questions are of increasing difficulty. Students may consult any book or notes during the test.

(5) ATTACHED BIBLIOGRAPHY

[1]. Fundamentals of Data Structures in C, by E. Horowitz, S. Sahni & S. Anderson-Freed, 2008
[2]. Data Structures Using C and C++, by Y. Langsam, M. Augenstein & A. Tenenbaum, 2013
[3]. Algorithms Illuminated (Part 2): Graph Algorithms and Data Structures (vol 2), by Tim Roughgarden, 2018
[4]. The Intuitive Guide to Data Structures and Algorithms, by Parker Phinney, 2018
[5]. Advances in Computational Algorithms and Data Analysis, by Sio-Iong Ao, 2009
[6]. C and Data Structures by Practice, by Ramesh Vasappanavara, 2007
[7]. Algorithms: Parallel and Sequential, by Umut A. Acar, 2019
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[10]. Compact Data Structures: A Practical Approach, by Gonzalo Navarro, 2016
[11]. Genetic Algorithms and Machine Learning for Programmers: Create AI Models and Evolve Solutions, by Frances Buontempo, 2019
[12]. Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles, 5th Edition, by Narasimha Karumanchi, 2016
[13]. Data Structures, Algorithms, And Applications In C++, by Sartaj Sahni, 2004
[14]. Data structures and algorithms in C++, by Michael T Goodrich, Roberto Tamassia & David M Mount, 2011
[15]. Data Structures Using C, by Reema Thareja, 2014
[16]. Basic Matrix Algebra with Algorithms and Applications, by Robert A. Liebler, 2003
[17]. Encyclopedia of Algorithms, by Ming-Yang Kao, 2016
[18]. Machine Learning Algorithms: Popular algorithms for data science and machine learning, 2nd Edition, by Giuseppe Bonaccorso, 2018
[19]. Data Structures and Algorithms in Python, by Michael T. Goodrich, Roberto Tamassia & Michael H. Goldwasser, 2013
[20]. Probabilistic Data Structures and Algorithms for Big Data Applications, by Andrii Gakhov, 2019