COURSE OUTLINE

1. GENERAL

SCHOOL	NATURAL SCIENCES		
DEPARTMENT	MATHEMATICS		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	MAT_IC438	**SEMESTER OF STUDIES**	8th
COURSE TITLE	ALGORITHMS AND COMPLEXITY		

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*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
Lectures and Tutorials	4	6
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*	Compulsory course for the specialization *Informatics and Computational Mathematics* Elective course for each of the other specializations
PREREQUISITE COURSES:	Recommended prerequisite knowledge: DATA STRUCTURES
TEACHING AND ASSESSMENT LANGUAGE:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No
COURSE WEBPAGE (URL)	https://eclass.math.upatras.gr/courses/MATHDEP176/

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*

With this course the student learns the basic concepts of efficient computation, of computing resources and algorithms complexity. Acquires basic knowledge in designing and analyzing algorithms. Understands the possibilities and restrictions of computational models and learns about the complexity classes P and NP. Learns the concept of completeness and the use of reductions as a tool in categorizing computational problems. Learns how to prove NP-completeness results and knows some important NP-complete problems.

General Abilities

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	*Others…*
Production of new research ideas	

- Adaptation to new situations.
- Work in an interdisciplinary environment.
- Excercise of criticism and self-criticism.
- Promotion of free, creative and inductive thinking.

3. COURSE CONTENT

The concept of efficient computation - computing resources - time, space. Algorithms complexity, optimal algorithms. Basic algorithm designing and analyzing techniques. Divide-and-Conquer. Greedy algorithms. Minimum spanning tress, the algorithms of Prim and Kruskal. Undirected graphs: depth-first-search. Cut points and biconnected components. Matching in bipartite graphs. Directed graphs: finding strongly connected components. Depth-first-search. Shortest path: Dijkstra, Bellman-Ford, topological ordering and shortest paths in directed acyclic graphs. Problem complexity. Examples. Computational models. Turing machine. Non-deterministic Turing machine. Universal Turing machine. Complexity classes and general relations among complexity classes. The concepts of reduction (logarithmic space – polynomial time) and completeness. The classes P and NP. NP-completeness. Cook's Theorem. Some NP-complete problems (satisfiability and variants, graph-theoretic problems, integer programming). Strong and weak NP-completeness.

4. TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING METHOD *Face-to-face, Distance learning, etc.*	Lectures (face to face)
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	
TEACHING ORGANIZATION *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*	

Activity	***Semester workload***
Lectures	52
Solving exercises	45
Hours of private study of the student	50
Final examination	3
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***150***

STUDENT ASSESSEMNT *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*	**Assessment Language:** Greek **Assessment Language for Erasmus students:** --- **Assessment methods:** Written final course exam including: ✓ Comprehensive questions ✓ Exercises and problem solving Minimum passing grade: 5 Μαximum passing grade: 10

5. RECOMMENDED LITERATURE

(*in Greek*)

- Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford. *Εισαγωγή στους Αλγόριθμους*. Εκδόσεις ΙΤΕ – Πανεπιστημιακές Εκδόσεις Κρήτης, 2016.