COURSE OUTLINE

1. GENERAL

SCHOOL	NATURAL SCIENCES		
DEPARTMENT	MATHEMATICS		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	MAT_IC233	**SEMESTER OF STUDIES**	6th
COURSE TITLE	MATHEMATICAL FOUNDATIONS OF THE THEORY OF COMPUTATION		

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: INTRODUCTION TO ALGEBRA AND SET THEORY, ΔΙΑΚΡΙΤΑ ΜΑΘΗΜΑΤΙΚΑ
TEACHING AND ASSESSMENT LANGUAGE:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No
COURSE WEBPAGE (URL)	https://eclass.upatras.gr/courses/MATH1061/

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*

By successfully attending this course the student will have further developed the following skills:

- To use the fundamental methods of proofs correctly and to recognize which is the proper method of proof for each problem.
- To understand the meaning of the formal deductive systems.
- To apply mathematical induction in order to verify recursive algorithms.
- To use Hoare Logic to prove that the partial and total correctness of algorithms and programs.
- To use relational databases for knowledge acquisition.
- To understand the concept of a formal language and some mechanisms of producing a formal language like the regular expressions and grammars.
- To understand the concept of an automaton and its limitations.
- To study a universal computational model like the Turing machine.
- To realize the existence of non-computable 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	*……*
Production of new research ideas	*Others…*

- Work in an interdisciplinary environment.
- Promotion of free, creative and inductive thinking.
- Autonomous work.

1. COURSE CONTENT

Part one: Logic and proof. A review of Logic of Propositions: Alphabet, syntax and semantics. A review of Logic of Predicates: Alphabet, syntax and semantics. Fundamental methods of roofs: Direct proof, Proof by contraposition, Existence Proof (constructive and non- constructive), Indirect proof, Proof by mathematical induction (weak and strong induction). Formal deductive systems: Hilbert-style systems, Semantic tableaux. Recursion and induction. Validation of programs by using Hoare Logic: Partial correctness of code, Total correctness of code. Relations-Relational databases (elementary presentation of Prolog).

Part two: Formal languages and automata. Alphabets and languages. Regular expressions and regular languages. Deterministic and non-deterministic finite automata. The pumping lemma for regular expressions. Context-free grammars and languages. Regular grammars. Grammar simplification. The pumping lemma for context-free languages. Pushdown automata. Turing machines. Computation using a Turing machine. Context sensitive grammars. Computability. Undecidable languages. Recursively enumerable languages. Ta limits of computability. Rice's Theorem.

2. 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*	The learning procedure is supported by the *eClass* platform of University of Patras.
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*	
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 Examination Minimum passing grade: 5 Maximum passing grade: 10

Activity	***Semester workload***
Lectures	52
Study (unsupervised)	95
Final examination	3
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***150***

3. RECOMMENDED LITERATURE

(*in Greek*)

- Μπουντουρίδης Μωυσής και Ράγγος Όμηρος. *Μαθηματικές Θεμελιώσεις της Θεωρίας Υπολογισμού*. Σημειώσεις μαθήματος, 2015.
- Sipser Michael. *Εισαγωγή στη Θεωρία Υπολογισμού*. Εκδόσεις ITE – Πανεπιστημιακές Εκδόσεις Κρήτης, 2011.
- Lewis Harry R. και Παπαδημητρίου Χρίστος Χ. *Στοιχεία Θεωρίας Υπολογισμού*. Εκδόσεις Κριτική, 2005.