**COURSE OUTLINE**

1. **GENERAL**

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| **SCHOOL** | ENGINEERING |
| **ACADEMIC UNIT** | Department of Computer Engineering and Informatics |
| **LEVEL OF STUDIES** | Undergraduate |
| **COURSE CODE** | **CEID\_22Υ109** | **SEMESTER** | **1st** |
| **COURSE TITLE** | DISCRETE MATHEMATICS |
| **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 and Tutorial Exercises | 3(L), 2(TE) | 5 |
| **Comprehension Exercises + 2 Quizzes** |  | 2 |
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| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* |  | 7 |
| **COURSE TYPE***general background, special background, specialised general knowledge, skills development* | General Background |
| **PREREQUISITE COURSES:** | Recommended prerequisite knowledge in high-school mathematics |
| **LANGUAGE OF INSTRUCTION and EXAMINATIONS:** | Greek |
| **IS THE COURSE OFFERED TO ERASMUS STUDENTS** | No |
| **COURSE WEBSITE (URL)** | <https://eclass.upatras.gr/courses/CEID1062/> |

1. **LEARNING OUTCOMES**

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| **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*
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| **Upon conclusion of the course the students ought to be able to:*** Comprehend the notion of proof in a formal manner.
* Provide logical arguments in the proof of a proposition.
* Use fundamental notions like sets, relations and functions.
* Understand fundamental notions of number theory.
* Find closed formulas for summations.
* Understand the fundamental notions in combinatorics.
* Count discrete events and use the right mathematical tools to solve counting problems.

**Upon conclusion of the course the students are expected to have the following skills/competences:*** Mathematically sound problem formulation.
* Prove propositions with logical arguments.
* Argue about sets and use them as a formulation for an extensive set of problems.
* Find closed solutions for summations.
* Solve counting problems with an extensive set of tools.
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| **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…**…….* |
| * Adapting to new situations
* Decision-making
* Production of free, creative and inductive thinking
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1. **SYLLABUS**

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| Propositional/Predicate Logic:* Logical Propositions – Operations – Truth Tables
* Translation to/from Natural Language
* Quantifiers
* Rules of Inference

Proof Techniques:* Implication Proofs (direct, indirect, contradiction)
* Case Analysis
* Equivalence
* Existential Proofs
* Proof by Counterexample
* Uniqueness Proof
* Proofs for Propositions with Universal Quantifiers
* Mathematical Induction

Fundamental Number Theory:* Integer Division
* Prime Numbers
* Modular Arithmetic

Set Theory:* Operations on Sets
* Powerset
* Cartesian Product
* Inclusion-Exclusion

Relations and Functions:* Properties of Relations
* The Function as a Special Case of a Relation
* Equivalence Relations

Sums – Products:* Properties of Sums
* The Technique of Equating Sums
* Guess and Prove by Induction
* Telescopic Sums
* Transformation of Products into Sums

Fundamental Combinatorics:* The Equivalence Principle, The Pigeonhole Principle
* Product and Sum Principles
* Samples – Combinations – Permutations – Choices
* Inclusion – Exclusion
* Balls in Bins
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1. **TEACHING and LEARNING METHODS - EVALUATION**

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| **DELIVERY***Face-to-face, Distance learning, etc.* | Face-to-face.  |
| **USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY** *Use of ICT in teaching, laboratory education, communication with students* | ICT methods are used in both teaching and communication with the students. Lecture slides and supplementary material are uploaded in the course’s web site. In case of distance lectures, the recording will be provided. |
| **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* |

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| ***Activity*** | ***Semester workload*** |
| Lectures | 3\*13=39 |
| Tutorials (exercises) | 2\*13=26 |
| Self-Study | 4\*13=52 |
| 5 comprehension exercises + a quiz | 5\*5+2\*6=37 |
| Exam preparation week + 2 weeks of vacation | 16+2\*4=24 |
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| Course total (25-30 hours per ECTS unit) | **178** |

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| **STUDENT PERFORMANCE EVALUATION***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.* | Language of evaluation: GreekFinal Examination (100% of total score)Written, graduated difficulty, covering all taught material.After the examination, the exam paper is uploaded along with indicative solutions.The comprehension exercises and the mid-term quiz aim at engaging students to follow and understand the taught material motivating them to do so by providing a small bonus (~1 point out of total 10). The quiz will consist of multiple-choice questions while the comprehension exercises will consist of easy problems. |

1. **ATTACHED BIBLIOGRAPHY**

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| *- Suggested bibliography:** K.H. Rosen. Discrete Mathematics and their Applications (Tziola Publishing), 8th Edition, 2018.
* C.L. Liu. Elements of Discrete Mathematics (PUC), 9th Edition, 2019.
* S.S. Epp. Discrete Mathematics with Applications (Kleidarithmos Publishing), 3rd Edition, 2010.
* Discrete Mathematics Α) The Mathematics of Computer Science, Β) Problems and Solutions Α)E. Kyroysis, C. Bouras and P. Spirakis, Β)G. Voutsadakis, E. Kyroysis, C. Bouras and P. Spirakis. G. Dardanos – K. Dardanos Publishing, 2008.
* Uploaded lecture notes and slides
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