(1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>Department of Computer Engineering and Informatics</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>Undergraduate</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>CEID_NY109</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>1st</td>
</tr>
</tbody>
</table>

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

| Lectures and Tutorial Exercises | 3(L), 2(TE) | 5 |
| Comprehension Exercises + 2 Quizzes | | 2 |

Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).

COURSE TYPE
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/

(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

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 and recursions.
- 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.
- Formulate and solve recurrence relations in related problems.
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
- Teamwork
- 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...

(3) SYLLABUS

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
- Approximation by Integrals
- 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

Generating Functions:
• Binomial Coefficients
• Properties of Generating Functions
• Generating Functions for Counting Objects
• Exponential Generating Functions

Recurrence Relations:
• Linear Recurrence Relations with Constant Coefficients
• Non-Linear Recurrence Relations

(4) TEACHING and LEARNING METHODS – EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lectures</td>
<td>3*13=39</td>
</tr>
<tr>
<td></td>
<td>Tutorials (exercises)</td>
<td>2*13=26</td>
</tr>
<tr>
<td></td>
<td>Self-Study</td>
<td>4*13=52</td>
</tr>
<tr>
<td></td>
<td>5 comprehension exercises + a quiz</td>
<td>5<em>5+2</em>6=37</td>
</tr>
<tr>
<td></td>
<td>Exam preparation week + 2 weeks of vacation</td>
<td>16+2*4=24</td>
</tr>
<tr>
<td></td>
<td>Course total (25-30 hours per ECTS unit)</td>
<td>178</td>
</tr>
</tbody>
</table>
### 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.

<table>
<thead>
<tr>
<th>Language of evaluation: Greek</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Examination (100% of total score)</td>
</tr>
<tr>
<td>Written, graduated difficulty, covering all taught material.</td>
</tr>
</tbody>
</table>

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.

### (5) ATTACHED BIBLIOGRAPHY

- **Suggested bibliography:**
  - Uploaded lecture notes and slides