# COURSE OUTLINE

## 1. GENERAL

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|---|---|---|---|
| **SCHOOL** | NATURAL SCIENCES | | |
| **DEPARTMENT** | MATHEMATICS | | |
| **LEVEL OF COURSE** | UNDERGRADUATE | | |
| **COURSE CODE** | MAT_PM265 | **SEMESTER OF STUDIES** | 4th |
| **COURSE TITLE** | NUMBER THEORY | | |

| **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 Laboratory Exercises | 5 | 6 |
| | | |
| | | |
| *Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).* | | |

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|---|---|
| **COURSE TYPE** *general background, special background, specialised general knowledge, skills development* | Elective course |
| **PREREQUISITE COURSES:** | |
| **TEACHING AND ASSESSMENT LANGUAGE:** | Greek |
| **THE COURSE IS OFFERED TO ERASMUS STUDENTS** | Yes |
| **COURSE WEBPAGE (URL)** | |
| | |

## 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 completion of this course, the student will have had a first contact with elementary number theory and its subfields: classical theory, analytic methods, diophantine equations, transcendental theory and elements of cryptography.

**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* | |

- Promote free, creative and inductive thinking.

## 3. COURSE CONTENT

Theorems and conjectures for primes: primes in arithmetic progressions, primes of special form, formulas for primes, distribution of primes. Arithmetic functions: number of divisors, sum of divisors, Euler function, Möbius function, Dirichlet convolution, Möbius inversion formula. Mersenne numbers, perfect numbers, Fermat numbers. Polynomial equations modulo n, quadratic residues, Legendre symbol, Jacobi symbol, Kronecker symbol, law of quadratic reciprocity. Pythagorean triples, non-linear Diophantine equations, method of infinite descent, Pell equation. Continued fractions, properties of convergents, best approximation of irrationals by rationals, periodicity of continued fractions. Theorems of Dirichlet and Liouville for diophantine approximations, elements of transcendental number theory. Representations of integers as sums of squares or as sums of higher powers, Waring's problem. Symmetric and non-symmetric cryptography. Pseudoprimes, Carmichael numbers, deterministic and non-deterministic primality tests. Factorization algorithms.

## 4. TEACHING AND LEARNING METHODS - ASSESSMENT

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|---|---|
| **TEACHING METHOD**<br>*Face-to-face, Distance learning, etc.* | Lectures (face to face) |
| **USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES**<br>*Use of ICT in teaching, laboratory education, communication with students* | PowerPoint slides<br>Support Learning through the *eClass* platform. |
| **TEACHING ORGANIZATION**<br>*The manner and methods of teaching are described in detail.*<br><br>*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.*<br><br>*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**<br>*Description of the evaluation procedure*<br><br>*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*<br><br>*Specifically-defined evaluation criteria are given, and if and where they are accessible to students* | **Assessment Language:** Greek<br>**Assessment Language for Erasmus students:** English<br><br>**Assessment methods:**<br>Final written examination<br><br>Minimum passing grade: 5<br>Maximum passing grade: 10 |

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

## 5. RECOMMENDED LITERATURE

(*in Greek*)


- Αντωνιάδης Ιωάννης και Κοντογεώργης Αριστείδης. *Θεωρία Αριθμών και Εφαρμογές*. (e-book). Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. Αποθετήριο "Κάλλιπος", 2015.
- Πουλάκης Δημήτριος. *Θεωρία Αριθμών*. Εκδόσεις Ζήτη, 1997.
- Δεριζιώτης Δημήτριος. *Μια Εισαγωγή στη Θεωρία Αριθμών*. 2η έκδοση, Εκδόσεις Σοφία, 2012.
- Apostol Tom. *Εισαγωγή στην Αναλυτική Θεωρία των Αριθμών*. Εκδόσεις Gutenberg, 1986.
- Πουλάκης Δημήτριος. *Υπολογιστική Θεωρία Αριθμών.* (e-book). Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών Αποθετήριο "Κάλλιπος", 2015.