COURSE OUTLINE

GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Department of Mathematics		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**MAY123**	**SEMESTER**	**1**
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*	**WEEKLY TEACHING HOURS**	**CREDITS**
	4	7,5
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*	General background
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://users.uoi.gr/abeligia/NumberTheory/NT2016/NT2016.html

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*

The main purpose of the course is the study of the structure and basic properties of all natural numbers, and more generally of all integers. This study is based on the fundamental concept of divisibility of natural numbers, and the (unique) factorization of a natural

number into prime factors.

The most important ideas, concepts and results that allow us to understand the structure and fundamental properties of all natural numbers with respect to divisibility, are as follows (Keywords of course):

- Divisibility, prime numbers, Euclidean algorithm, greatest common divisor and least common multiple.
- Congruences and systems of congruences, Chinese remainder theorem.
- Arithmetical functions and Moebius inversion formula. Euler's ϕ-function.
- Theorems of Fermat, Euler and Wilson.
- Primitive mod p roots. Theory of indices and quadratic residues.
- Law of quadratic reciprocity.
- Applications to cryptosystems.

We will formulate and prove several theorems concerning the structure of all integers through the concept of divisibility. During the course will analyse applications of Number Theory to other sciences, and particularly to Cryptography.

This course is an introduction to the basic results, the basic methods, and the basic problems of elementary number theory, and requires no special knowledge of other subjects of the curriculum.

At the end of the course we expect the student to (a) have understood the definitions and basic theorems concerning the divisibility structure of the integers which are discussed in the course, (b) to have understood how they are applied in discrete examples, (c) to be able to apply the material in order to extract new elementary conclusions, and finally (d) to perform some (no so obvious) calculations.

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

The course aims to enable the undergraduate student to acquire the ability to analyse and synthesize basic knowledge of the theory of numbers, to apply basic examples in other areas, and in particular to solve concrete problems concerning properties of numbers occurring in everyday life. The contact of the undergraduate student with the ideas and concepts of the theory of numbers, promotes the creative, analytical and deductive thinking and the ability to apply abstract knowledge in various fields.

SYLLABUS

- Divisibility.
- Congruences mod m.
- Chinese remainder theorem.
- Arithmetical functions and Moebius inversion formula.
- The theorems of Fermat, Euler and Wilson.
- Primitive roots mod p.
- The theory of indices and the Law of quadratic reciprocity.
- Applications to cryptography.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face to face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td></td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>52</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Study of the elements of the theory and methods for solving exercises</td><td>26</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>78</td></tr>
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</td></tr>
<tr><td>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</td><td>Written final exams, in Greek language, combining analysis of theoretical topics and problem solving.</td></tr>
</table>

patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. **D. Poulakis**: "*Number theory*", Ziti Press, (1997).
2. **D. Deriziotis**: "*An introduction to Number theory*'', Sofia Press, (2007).

- Related academic journals: -