COURSE OUTLINE

1. GENERAL

SCHOOL	NATURAL SCIENCES		
DEPARTMENT	MATHEMATICS		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	MAT_PM103	**SEMESTER OF STUDIES**	1st
COURSE TITLE	CALCULUS I		

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	5	8
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*	Background
PREREQUISITE COURSES:	
TEACHING AND ASSESSMENT LANGUAGE:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	No
COURSE WEBPAGE (URL)	https://eclass.math.upatras.gr/courses/MATHDEP224/ https://eclass.upatras.gr/courses/MATH969/

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*

- Ability to understand and prove inequalities that hold for every positive integer.
- Some understanding of the definition of supremum and infimum.
- Ability to understand the definition of supremum and infimum. Ability to calculate supremum and infimum.
- Ability to understand the notions of sequence and series of real numbers. Ability to understand the notion of convergence for sequences and series.
- Ability to understand rigorous proofs concerning the algebra of limits and the convergence of basic sequences and series.
- Ability to calculate limits of sequences of real numbers. Ability to understand and prove whether an easy series of positive numbers converges.
- Ability to understand the rigorous definition of the limit of a function. Ability to calculate limits of functions. Knowledge of basic theorems on continuity and differentiability and their involvement to different 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 *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 introductory course of Real Analysis aims to introduce students to “rigorous proof” and “abstraction” in mathematics. Therefore this course arguably promotes *free, creative and inductive thinking.*

Moreover, since the rigorous approach is entirely different from what is taught in high school mathematics, this process *develops the ability of the student to adjust to new situations.*

Finally, understanding the rigorous definitions of this course develops *criticism and self-criticism.* This is the only way to realize why mathematicians were led to these definitions and what the whole theory aims to achieve.

3. COURSE CONTENT

Positive integers, induction, real numbers, operations, ordering, the concepts of supremum and infimum. Axiom of completeness, *n*-th root function. Sequences, increasing and bounded sequences, sequences that converge to their supremum. Algebra of limits. Series of numbers, geometric series, absolute convergence, ratio test and *n*-th root test. Definition of e, exponential and logarithmic function. Limit of a function, continuity of a function, algebra of limits and continuity of functions. Intermediate value theorem, derivatives, algebra of derivatives, geometric interpretation, differential, Rolle’s theorem, mean value theorem, monotonicity, extrema, convexity and graph of a function.

In order to highlight the special educational and didactical aspects of a course, special emphasis is given on the historical evolution and scientific development of the subject as well as on its applications in technology and/or other sciences.

4. 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*	Communication with students via *eClass* (announcements, messages, suggested exercises, answer to questions etc.) and existence of videos in *eClass* (presentation of some proofs-aim: to give the opportunity to the student to follow some proofs from anywhere at any time).
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*	(see table below)

Activity	*Semester workload*
Lectures	39
Tutorials	26
Solving suggested exercises	52
Hours of personal study by the student	80
Final examination	3
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***200***

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 (100%) including ✓ Theory, ✓ Exercises. Minimum passing grade: 5 Maximum passing grade: 10

5. RECOMMENDED LITERATURE

(*in Greek*)

- Spivak Michael. *Διαφορικός & Ολοκληρωτικός Λογισμός* (μετάφραση της 4ης Αμερικάνικης Έκδοσης). 2η Έκδοση, Εκδόσεις ΙΤΕ – Πανεπιστημιακές Εκδόσεις Κρήτης, 2015.
- Νεγρεπόντης Στυλιανός, Γιωτόπουλος Σταύρος και Γιαννακούλιας Ευστάθιος**.** *Απειροστικός Λογισμός. Τόμος Ι*. Εκδόσεις Συμμετρία, 1999.
- Τσίτσας Λεωνίδας. *Εφαρμοσμένος Απειροστικός Λογισμός*. 2η έκδοση, Σ.ΑΘΑΝΑΣΟΠΟΥΛΟΣ & ΣΙΑ Ι.Κ.Ε., 2003.

(*in English*)

- Spivak Michael. *Calculus*. 4th ed., Publish or Perish, 2008.
- Rudin Walter. *Principles of Mathematical Analysis*. 3rd ed., McGraw-Hill Education, 1976.