COURSE OUTLINE

GENERAL

SCHOOL	School of Science
ACADEMIC UNIT	Department of Mathematics
LEVEL OF STUDIES	Undergraduate

COURSE CODE	MAY111	**SEMESTER**	1st

COURSE TITLE	Infinetisimal Calculus 1

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**
	5	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:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (exams in English are provided for foreign students)
COURSE WEBSITE (URL)	http://www.math.uoi.gr/GR/studies/undergraduate/courses/may111.htm

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*

This course is the first contact of the undergraduate student with the branch of Analysis. In this course the students will get the necessary knowledge for a large portion of their studies in the Department of Mathematics. They also learn that the verification of any mathematical statement requires a proof.

a) The students learn the axiomatic foundation of the set R of real numbers. Emphasis is given in the notions of supremum and infimum as well as in the use of mathematical induction.

b) The students learn the notion of convergence of sequences, having their first contact with the ε-n_0 definition. They also learn how to calculate limits of sequences.

c) The students learn the notion of continuity of functions, having their first contact with the ε-δ definition. They learn the characterization of continuity via sequences and the proof of the basic theorems concerning continuous functions. They also learn the ε-δ definition regarding limits of real functions.

d) The students learn the notion of derivation, the use of first and second derivative in order to study the monotonicity and the curvature of a real function, as well as applications of derivatives in sciences. They also learn the proof of De L' Hospital Theorem and the theory concerning the Mean Value Theorems.

SYLLABUS

Real numbers, axiomatic foundation of the set of real numbers (emphasis in the notion of supremum and infimim), natural numbers, induction, classical inequalities.

Functions, graph of a function, monotone functions, bounded functions, periodic functions. Injective and surjective functions, inverse of a function. Trigonometric functions, inverse trigonometric functions, exponential and logarithmic functions, hyperbolic and inverse hyperbolic functions.

Sequences of real numbers, convergent sequences, monotone sequences, sequences defined by recursion, limits of monotone sequences, nested intervals. The notion of subsequence, Bolzano Weierstass' Theorem, Cauchy sequences. Accumulation points of sequences, upper and lower limit of a sequence (limsup, liminf).

Continuity of functions, accumulation points and isolated points, limits of functions, one sided limits, limits on plus infinity and minus infinity. Continuity of several basic functions, local behaviour of a continuous function. Bolzano Theorem and intermediate value theorem. Characterization of continuity via sequences, properties of continuous functions defined on closed intervals, continuity of inverse functions.

Derivative of a function, definition and geometric interpretation, examples and applications in sciences. The derivatives of elementary functions, derivation rules, higher order derivation. Rolle's Theorem, Mean Value Theorem, Darboux's theorem. Derivative and the monotonicity of a function, extrema of functions, convex and concave functions, inflection points. Derivation of inverse functions. Generalized Mean Value Theorem, De L' Hospital rule. Study of functions using derivatives.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Due to the theoretical nature of this course the teaching is exclusively given in the blackboard by the teacher.	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	The students may contact their teachers by electronic means, i.e. by e-mail.	
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*	***Activity***	***Semester workload***
	Lectures	65 hours
	Studying theory and solving exercises	65 hours
	Course total	130 hours

as the hours of non-directed study according to the principles of the ECTS	
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.*	Exams in the end of the semester (mandatory). Assignments of exercises during the semester (optional).

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Γενικά Μαθηματικά -Απειροστικος Λογισμός τόμος I, Χ. Αθανασιάδης, Ε. Γιαννακούλιας, Σ. Γιωτόπουλος, Εκδόσεις Συμμετρία.

- "Απειροστικός Λογισμός Τόμος I" Σ. Νεγρεπόντης, Σ. Γιωτόπουλος, Ε. Γιαννακούλιας, Εκδόσεις Ζήτη.

- "Απειροστικός Λογισμός I" Σ. Ντούγιας, Leader Books.

- "Thomas, Απειροστικός Λογισμός", R.L. Finney, M. D. Weir, F.R. Giordano, Πανεπιστημιακές Εκδόσεις Κρήτης, (Απόδοση στα ελληνικά: Μ. Αντωνογιαννάκης).

- "Διαφορικός και Ολοκληρωρικός Λογισμός: Μια εισαγωγή στην Ανάλυση", Michael Spivak, Πανεπιστημιακές Εκδόσεις Κρήτης (Μετάφραση στα ελληνικά: Α. Γιαννόπουλος).