COURSE OUTLINE

1. GENERAL

SCHOOL	NATURAL SCIENCES		
DEPARTMENT	MATHEMATICS		
LEVEL OF COURSE	UNDERGRADUATE		
COURSE CODE	MAT_AM202	**SEMESTER OF STUDIES**	4th
COURSE TITLE	REAL ANALYSIS 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	6
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:	Recommended prerequisite knowledge: CALCULUS I, II and III
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*

The course aims at the better understanding of the structure of the set of real numbers and of those properties that allow the development of Analysis. The student should become comfortable in handling in a rigorous way sequences and series of real numbers and using finer criteria with respect to their convergence. Furthermore (s)he gets a thorough understanding of the topology of two-dimensional and three-dimensional space. Through that the student is introduced to the abstract concept of metric space.

The student that successfully completes this course has a working knowledge of basic topological concepts (open and closed set, interior and closure of a subset), understands the various equivalent reformulations of them and the formulation of continuity of a function in such terms. Becomes acquainted with the basic theory of completeness of a metric space and its importance in proving various existence theorems in Analysis.

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	

During the course, the students develop additional skills and general abilities in the following fields (from the list above):

- Finding, analyzing and combining facts and information using the most suitable technologies.
- Adapting to new situations.
- Decision making.
- Working and studying autonomously.
- Working in a team.
- Generating new research ideas.
- Stimulating free, creative and constructive thinking.

3. COURSE CONTENT

Students enrolled 2018 onwards

Supremum, infimum, limsup, liminf. Cauchy completeness of the real numbers, order completeness, Archimedean property. Series of numbers, ratio and root tests in terms of limsup, liminf. Condensation and Raabe tests. Alternating series, rearrangements, products of series. Topology of R^2 and R^3. Convergences and continuity of functions of several real variables. The concept of metric space. Metrics on R^n, Holder – Minkowski inequalities. Open and closed sets, interior and closure. Continuous functions. Complete metric spaces, sequences of nested closed sets, Cantor's theorem. Banach's fixed-point theorem. Applications: Picard's theorem, implicit function's theorem.

Students enrolled before 2018

Parameterization of curves, length element. One-dimensional line integrals of the 1^{st} and 2^{nd} kind. Work performed by a force. Parameterization of surfaces, surface element. Surface (double) integrals of the 1^{st} and 2^{nd} kind. Computation of area, flux through a surface, and other physical quantities. Triple integrals, volume element. Transformation between various coordinate systems. Theorems of Green, Stokes and Gauss. Curl-free (conservative) vector fields and the concept of scalar potential. Divergence-free (incompressible) vector fields and the concept of vector potential. Applications in the 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*	
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*	

Activity	***Semester workload***
Lectures	39
Tutorials	26
Study and analysis of bibliography	82
Final Examination	3
Total number of hours for the Course (25 hours of work-load per ECTS credit)	***150***

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:** English **Assessment methods:** Written final examination (100%) including: ✓ Theory, ✓ Exercises, ✓ Applications of Vector Calculus and Multivariate Integral Calculus in the Physical Sciences. Minimum passing grade: 5 Maximum passing grade: 10

5. RECOMMENDED LITERATURE

(*in Greek*)

- Νεγρεπόντης Στυλιανός,Γιωτόπουλος Σ. Χ. και Γιαννακούλιας Ευστάθιος. *Απειροστικός Λογισμος, Τόμος Ι*. Εκδόσεις Συμμετρία, 1999.
- Μπετσάκος Δημήτριος. *Εισαγωγή στην Πραγματική Ανάλυση*. Εκδόσεις Αφοι Κυριακίδη, 2016.
- Ανούσης Μιχάλης,Τσολομύτης Αντώνης,Φελουζής Βαγγέλης. *Πραγματική Ανάλυση*. Εκδόσεις Συμμετρία, 2014.
- Marsden Jerrold E. and Tromba Anthony J. *Διανυσματικός Λογισμός* (μετάφραση της 3ης Αμερικάνικης Έκδοσης). Εκδόσεις ΙΤΕ – Πανεπιστημιακές Εκδόσεις Κρήτης, 2015.
- Brand Louis. *Μαθηματική Ανάλυση*. Εκδόσεις Ελληνικής Μαθηματικής Εταιρείας, 1984.

(*in English*)

- Marsden Jerrold E. and Tromba Anthony J. *Vector Calculus*. 6th ed., W.H. Freeman & Co., 2012.
- Schey Harry M. *Div, Grad, Curl, and All That: an Informal Text on Vector Calculus*. 4th ed., W.W. Norton & Co., 2004.