

COURSE OUTLINE

GENERAL

SCHOOL	School of Science		
ACADEMIC UNIT	Department of Mathematics		
LEVEL OF STUDIES	Undregraduate		
COURSE CODE	711	SEMESTER	7th
COURSE TITLE	Functional Analysis I		
INDEPENDENT TEACHING ACTIVITIES <i>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</i>	WEEKLY TEACHING HOURS	CREDITS	
	3	6	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Specialized general knowledge and special background.		
PREREQUISITE COURSES:	None (from the typical point of view). In order to be able to follow this course, the knowledge from the following courses is required. Infinitesimal Calculus I Infinitesimal Calculus I Introduction to Topology		
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)			

LEARNING OUTCOMES

<p>Learning outcomes <i>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.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i>
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The goal of this course is:

To familiarize the student with the notions the theorems and the techniques concerning Banach spaces, bounded linear operators between them, dual spaces and especially Hilbert spaces.

After completing this course the student will be able to recognize if a given normed linear space is a Banach space, to compute the norm of a bounded linear operator, will be able to use the basic theorems of Functional analysis (Hahn-Banach theorem and its consequences, Open mapping theorem, Uniform Boundedness Principle), and will get the basic theorems and techniques concerning Hilbert spaces (e.g. existence of orthonormal bases, Gram-Schmidt orthogonalization procedure, isometry of every Hilbert space with its dual).

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

This course aims to provide the student with the theoretical background and the fluency of using the basic theorems and techniques of Functional Analysis. Promotes the analytical and synthetic thinking that the student will be able to apply the knowledge acquired in a broader scope including the whole range of mathematical analysis.

SYLLABUS

Linear spaces and algebraic bases (Hamel bases), linear operators. Normed spaces, Banach spaces, classical examples. Bounded linear operators, dual spaces, conjugate operators. Hahn Banach theorem and its consequences. Reflexive spaces. Inner product spaces, Hilbert spaces, orthonormal systems, every Hilbert space is isometric with its dual. Baire's category theorem and some of its consequences in Functional Analysis (Open Mapping Theorem, Closed graph Theorem, Uniform Boundedness Principle, Banach Steinhaus Theorem).

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TEACHING and LEARNING METHODS - EVALUATION

<p>DELIVERY <i>Face-to-face, Distance learning, etc.</i></p>	Teaching on the blackboard from the teacher.	
<p>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i></p>	Communication with the teacher by electronic means (i.e. e-mail).	
<p>TEACHING METHODS <i>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.</i></p> <p><i>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</i></p>	Activity	Semester workload
	Lectures	39 hours
	Study of theory and solving exercises	41 hours
	Course total	80 hours
	<p>STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i></p> <p><i>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</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	Exams in the end of the semester (mandatory), intermediate exams (optional), assignments of exercises during the semester (optional).

ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

Γενική Τοπολογία και Συναρτησιακή Ανάλυση, Σ. Νεγρεπόντης, Θ. Ζαχαριάδης, Ν. Καλαμίδας, Β. Φαρμάκη, Εκδόσεις Συμμετρία, (κωδικός στο σύστημα Εύδοξος: 45321).

Στοιχεία Συναρτησιακής Ανάλυσης, Χ. Καρυοφύλλης, Εκδόσεις Ζήτη (κωδικός στο σύστημα Εύδοξος: 11278).

Συναρτησιακή Ανάλυση, Haim Brezis, Εκδόσεις Ε.Μ.Π. (κωδικός στο σύστημα Εύδοξος: 20956).