



# Kırıkkale University

FACULTY OF ARTS AND SCIENCES  
MATHEMATICS

MAT4001 Functional Analysis					
Semester	Course Unit Code	Course Unit Title	L+P	Credit	Number of ECTS Credits
7	MAT4001	Functional Analysis	4	4	6

**Mode of Delivery:**

Face to Face

**Language of Instruction:**

Türkisch

**Level of Course Unit:**

Bachelor's Degree

**Work Placement(s):**

No

**Department / Program:**

MATHEMATICS

**Type of Course Unit:**

Elective

**Objectives of the Course:**

To teach the notions of metric spaces. To introduce vector spaces, normed vector spaces, Banach spaces, inner product spaces and Hilbert spaces. To teach their properties.

**Teaching Methods and Techniques:**

Metric spaces. Vector spaces. Normed vector spaces. Banach spaces. Inner product and Hilbert spaces. Basic properties of these spaces.

**Prerequisites and co-requisites:****Course Coordinator:****Name of Lecturers:**

Prof. Dr. İshak ALTUNDr. Öğr. Üyesi Hatice A. HançerProf. Dr. Hakan Şimşek

**Assistants:****Recommended or Required Reading****Resources**

Bayraktar, Mustafa, Functional Analysis, Gazi Kitabevi, 2006, Ankara, Soykan, Yüksel, Functional Analysis, Lecture, Drilland Practice, Problem Solving, Discussion, Question and answer  
Musayev, Binali; Fonksiyonel Analiz, Balçu Yayınları, 2000, İstanbul.  
Şuhubi, Erdoğan; Fonksiyonel Analiz, İTÜ Vakfı, 2001, İstanbul

**Course Category**

Mathematics and Basic Sciences :

Engineering :

Engineering Design :

Social Sciences :

Education :

Science :

Health :

Field :

**Weekly Detailed Course Contents**

Week	Topics	Study Materials	Materials
1	Metric Spaces ,Complete Metric Spaces		
2	Normed Spaces		
3	Banach Spaces		
4	Bounded dimensional Spaces		
5	linear operators , Dual Spaces		
6	Bounded and convergence linear operators		
7	Bounded expanded Linear operators and Dual Spaces		
8	Midterm		
9	Hahn-Banach theorem		
10	Closed maps theorem , Open maps theorem		
11	İnner product Spaces		
12	Hilbert Spaces		
13	Demonstrated Functionals on Hilbert Spaces		
14	Spectral theory on finite-dimension norm spaces		
15	Spectral theory on finite-dimension norm spaces		

**Course Learning Outcomes****No Learning Outcomes**

C01 To understand the structure of linear and normed spaces. To be able to prove theorems related to linear operators and linear functionals.

**Program Learning Outcomes****No Learning Outcome**

P09 Independently carries out research in the field of Mathematical Sciences.  
P08 Uses the ability of abstract thinking.  
P07 Solves numerical, algebraic, geometric and spatial expressions, equations, functions and problems.  
P12 Develops new ideas in the field of Mathematical Sciences.  
P11 Updates their current knowledge in the field of Mathematical Sciences.  
P10 Critically evaluates the knowledge and skills acquired in the field.  
P03 Advanced undergraduate subjects will have the qualifications to carry out the work independently in partnership.  
P02 The fundamental notions, theories and data, evaluating scientific methods, identify and analyze problems and issues encountered in discussions, makes recommendations based on research evidence.  
P01 Based on efficiencies gained by using materials related to mathematics in secondary education, is equipped with advanced knowledge.  
P06 Interprets abstract mathematical concepts, including rings and abstract algebra, and critical reasoning.  
P05 Interprets mathematical and statistical models such as formulas, functions, graphs, tables, and schematics.  
P04 Can express mathematical information numerically, symbolically, graphically, verbally, and visually.

Assessment Methods and Criteria		
In-Term Studies	Quantity	Percentage
Mid-terms	1	%40
Quizzes	0	%0
Assignment	0	%0
Attendance	0	%0
Practice	0	%0
Project	0	%0
Final examination	1	%60
<b>Total</b>		<b>%100</b>

ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration	Total Work Load
Course Duration	16	4	64
Hours for off-the-c.r.stud	14	4	56
Assignments	3	10	30
Presentation	0	0	0
Mid-terms	1	20	20
Practice	0	0	0
Laboratory	0	0	0
Project	0	0	0
Final examination	1	30	30
<b>Total Work Load</b>			<b>200</b>
<b>ECTS Credit of the Course</b>			<b>7</b>

Contribution of Learning Outcomes to Programme Outcomes												
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	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
All	4	5	4	4	4	5	4	5	4	4	4	5
C01	5	5	5	5	5	5	4	5	5	5	5	5

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