AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Functional Analysis For Physicists								
Course Code	FZK527		Couse Level	Second Cycle (Master's Degree)					
ECTS Credit	6	Workload	150 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course	Description of functional analysis which is the mathematical basis of quantum mechanics								
Course Content	Linear spaces, linear operators, operator algebra, apllication to quantum mechanics								
Work Placement									
Planned Learning Activities and Teaching Methods	Explanation (Presentation), Discussion, Individual Study, Problem Solving								
Name of Lecturer(s)									

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	1	20
Final Examination	1	30
Quiz	2	8
Attending Lectures	14	28
Assignment	14	14

Recommended or Required Reading	
1	Linear Operators for Quantum mechanics, T. F. Jordan, 1997, Dover, New York
2	Theory of Linear Operators in Hilbert Space, N.I. Akhiezer, I.M.Glazman, 1993, Dover, NewYork
3	Introductory Functional Analysis with Applications, Erwin Kreyzig
4	Calculus, T.M. Apostol, 2.ed, 1967, New York, John Wiley Sons

Week	Weekly Detailed Course Contents	
1	Theoretical	Metric spaces
	Preparation Work	Apostol T.M., Calculus, Chapter2
2	Theoretical	Normed spaces, Banach spaces
	Preparation Work	Kreyzig E, Introductory Functional Analysis with Applications, Chapter2
3	Theoretical	Inner product spaces and Hilbert spaces
	Preparation Work	Thomas F., Linear Operators for Quantum mechanics, Section 1.3
4	Theoretical	Linear functionals
	Preparation Work	Thomas F., Linear Operators for Quantum mechanics, Section 1.4
5	Theoretical	Bounded linear operators
	Preparation Work	Thomas F., Linear Operators for Quantum mechanics, Section 2.1-2,3
6	Theoretical	Projection operators
	Preparation Work	Thomas F., Linear Operators for Quantum mechanics, Section 2.10
7	Theoretical	Unitary operators
	Preparation Work	Akhiezer L.I, Glazman I.M., Theory of Linear Operators in Hilbert Space, Section 3.35
8	Intermediate Exam	Midterm Exam
9	Theoretical	Closed operators and adjoint of an operator
	Preparation Work	Akhiezer L.I, Glazman I.M., Theory of Linear Operators in Hilbert Space, Section 4.38
10	Theoretical	Self-adjoint operators
	Preparation Work	Akhiezer L.I, Glazman I.M., Theory of Linear Operators in Hilbert Space, Section 4.39
11	Theoretical	Concept of spectrum
	Preparation Work	Akhiezer L.I, Glazman I.M., Theory of Linear Operators in Hilbert Space, Section 4.41; Thomas F., Linear Operators for Quantum mechanics, Section 3.12, 3.13
12	Theoretical	Core of an operator
	Preparation Work	Akhiezer L.I, Glazman I.M., Theory of Linear Operators in Hilbert Space, Section 4.44
13	Theoretical	Spectral analysis of unitary and self-adjoint operators
	Preparation Work	Thomas F., Linear Operators for Quantum mechanics, Section 2.14

14	Theoretical	Spectral analysis of unitary and self-adjoint operators
	Preparation Work	Thomas F., Linear Operators for Quantum mechanics, Section 2.15
15	Theoretical	Self-adjoint extension of operators
	Preparation Work	Akhiezer L.I, Glazman I.M., Theory of Linear Operators in Hilbert Space, Chapter5
16	Final Exam	Final Exam

Workload Calculation

Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	1	3	56
Assignment	12	1	2	36
Quiz	4	1	1	8
Midterm Examination	1	17	5	22
Final Examination	1	23	5	28
			Total Workload (Hours)	150
			[Total Workload (Hours) / 25*] = **ECTS**	6

**25 hour workload is accepted as 1 ECTS*

Learning Outcomes

1	To be able to express the definition of linear vector spaces
2	To be able to perform the spectral decomposition of self-adjoint operators
3	To be able to explain the operator core concept
4	To be able to explain the difference between the concepts of state and observable
5	To be able to apply the functional analysis methods to quantum mechanical problems

Programme Outcomes *(Physics Master)*

1	The student should conceive the concepts in physics and may apply them on her/his own
2	The student should be able to conceive the relationship between the different physics laws and integrity of them and apply them in solving different physics problems
3	The student should know the basic principles of classical, quantum and relativistic physics and use them in the solutions of problems
4	The student should be able to do research in a specific area of physics
5	The student should be able to prepare reports on papers on the subject of her/his research and present her/his research subject in scientific conferences
6	The student should be able to explain the relationship between complicated problems and basic physics laws.
7	The student should be able to use computers for solving complicated physics problems
8	The student should be able to interrelate between the theory and the experiment. If she/he is experimentalist he/she has to explain the theory behind her/his work. If she /he is a theorist she/he should has to know the experiments in her/his subject.

Contribution of Learning Outcomes to Programme Outcomes *1:Very Low, 2:Low, 3:Medium, 4:High, 5:Very High*

	L1	L2	L3	L4	L5
P1	5	5	5	5	5
P2	2	2	4	4	2
P3	3	3	4	4	4
P4	3	3	3	3	3
P5	1	1	2	1	1
P6	3	3	3	4	3
P7	1	1	1	1	1
P8	2	1	3	1	1