COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
ADVANCED QUANTUM MECHANICS	PHYS 632	4	3+ 0+0	3	10

Prerequisites	

Language of Instruction	English
Course Level	Graduate
Course Type	Compulsory
Course Coordinator	Prof. Dr. Avadis Hacınlıyan
Instructors	Prof. Dr. Avadis Hacınlıyan
Assistants	
Goals	Advanced topics in quantum mechanics. Classical electromagnetic fields, gauge transformations, classical special relativity theory, Second quantization. Relativistic quantum theory, Klein Gordon and Dirac equations. Advanced scattering theory and covariant perturbation theory (Feynman graphs), Renormalization in quantum electrodynamics.
Content	Continuation of Quantum Mechanics I

Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1) Introduces the covariant formulation of special relativistic mechanics and electromagnetic theory.	1,2,3	A,B,C
2) Radyasyon ve madde etkileşmesini öğretir.	1,2,3	A,B,C
3) Develops skills to apply knowledge of physics and mathematics.	1,2,3	A,B
4) Teaches Feynman graphs as theory of fundamental processes.	1,2,3	A,B
5) Introduces exact and approximate calculation methods.	1,2,3	A,B
6) Develop skill to define formulate and solve physics problems.	1,2,3	A,B
7) Develop skill to apply techniques and devices necessary for physical applications	1,2,3	A,B,C

Teaching Methods:	1: Lecture, 2: Problem Sets 3: Problem Sessions: Case Study
Assessment Methods:	A: Testing, B: Homework C: Presentation

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Four vectors in special relativity	Modern Phys. Math. Meth. Phys.
2	Covariant formulation of Maxwell's equations. Gauge transformations.	Electromagnetic Theory
3	Scattering theory and the scattering matrix.	Quantum Mechanics
4	Second quantization of the electromagnetic field.	Electrodynamics, quantum mechanics, Fourier Analysis.
5	Operators, Symmetryt and Consertvation Laws, Noether's Theorem.	Classical Mechanics
6	Quantization of spin 0 fields. Klein Gordon Equation. Higgs Theory.	Quantum Mechanics, Math. Math. Phys.
7	Midterm Examination	
8	Dirac Equation and its plane wave solutions.	
9	Quantization of spin ½ fields.	
10	Covariant Perturbation Theory	
11	Feynman Diagrams	
12	Pair production, Compton Scattering, V-A theory in beta decay	Modern Physics
13	Introduction to gauge theories	
14	General Revision and midterm exam	

RECOMMENDED SOURCES	
Textbook	J. J. Sakurai Advanced Quantum Mechanics, Pearson (Addison Wesley, 1967) 2006.
Additional Resources	R. P. Feynman Quantum Electrodynamics W. A. Benjamin (1961) J. D. Bjorken, S. Drell, Relativistic Quantum Mechanics ve Relativistic Quantum Fields, McGraw-Hill, (1964)

MATERIAL SHARING

Documents	"Quantum Field Theory Demystified" David McMahan, Schaum's Outline of Theory and Problems of Quantum Mechanics" by D. Mac Mahon (2008)
Assignments	From the textbook
Exams	

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	2	80
Quizzes	4	10
Assignment	8	10
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

COURSE'S CONTRIBUTION TO PROGRAM

No	Program Learning Outcomes	Contribution				
		1	2	3	4	5
1	Gets a sound base for the main fields of physics such as Classical Mechanics, Quantum Mechanics and Electromagnetism,					X
2	Gets the ability of interpreting, analysing, forming a synthesis and relationships between the main fields of physics and/or other sciences,					X
3	Obtains the education required for the measurements in scientific and technological areas and the contribution of physics in the industrial applications and on the macroscopic scale such as the society,				X	
4	Follows the up-to-date scientific developments, makes the analysis/synthesis for the new ideas and evaluates them,				X	
5	Uses the academic sources, the computer technology and the related devices,		X			
6	Joins the working and research groups, also the scientific meetings, communicates well at the national and international level,		X			
7	Gets the ability of creative and critical thinking, problem solving, researching, producing a new and original work, improving himself/herself in his/her own fields of interest,					X
8	Gains the concepts of ethics and responsibility. Undertakes the responsibility for the solutions to the problems related with his/her field as required for having an intellectual identity.		X			

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam week: 14x Total course hours)	14	3	42
Hours for off-the-classroom study (Pre-study, practice)	14	6	84
Mid-terms	2	10	20
Quizzes	4	1	4
Assignment	8	3	24
Presentation	5	8	40
Final examination (with reparatioın)	2	10	20
Total Work Load			248
Total Work Load / 25 (h)			9.92
ECTS Credit of the Course			10