AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title		Relativistic Quantum Mechanics							
Course Code		FZK608		Couse Level		Third Cycle (Doctorate Degree)			
ECTS Credit	7	Workload	178 *(Hours)*	Theory	3	Practice	0	Laboratory	0
Objectives of the Course		Relativistic Quantum Physics is a course where important theories for elementary particle physics and symmetries are learned. During the course, it will be illustrated how relativistic symmetries and gauge symmetries can restrict "possible" theories. The course will give an introduction to perturbation theory and Feynman diagrams.							
Course Content		Tensor notation. Casimir operators. The Poincaré group. Irreducible representations of particles. The Klein-Gordon equation. The Dirac equation. The structure of Dirac particles. The Dirac equation: central potentials. The Weyl equation.							
Work Placement		N/A							
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	W. Greiner, Relativistic Quantum Mechanics - Wave Equations, Springer (2000)
2	M.E. Peskin and D.V. Schroeder, Introduction to Quantum Field Theory, Harper-Collins (1995)
3	F. Schwabl, Advanced Quantum Mechanics, Springer (1999)
4	F. Gross, Relativistic Quantum Mechanics and Field Theory, Wiley (1993)

Week	**Weekly Detailed Course Contents**	
1	Theoretical	Relativistic Wave Equation for Spin-0 Particles: The Klein-Gordon Equation and Its Applications
2	Theoretical	Interpretation of One-Particle Operators in Relativistic Quantum mechanics
3	Theoretical	A Wave Equation for Spin-1/2 Particles: Dirac Equation
4	Theoretical	Nonrelativistic Limit of the Dirac Equation
5	Theoretical	Lorentz Covariance of the Dirac Equation
6	Theoretical	Finite Proper Lorentz Transformations
7	Theoretical	Spiniors Under Spatial Reflection
8	Intermediate Exam	Midterm Exam
9	Theoretical	Bilinear Covariants of the Dirac Spinors
10	Theoretical	Plane Waves in Arbitrary Directions
11	Theoretical	Polarized Electrons in Relativistic Theory
12	Theoretical	Projection Operators for Energy and Spin
13	Theoretical	Wave Packets of Plane Dirac Waves
14	Theoretical	Klein's Paradox
15	Theoretical	Massless Particles : Graphene
16	Final Exam	Final Exam

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	3	3	84
Assignment	7	3	1	28
Quiz	2	4	1	10

Midterm Examination	1	20	3	23
Final Examination	1	30	3	33
			Total Workload (Hours)	178
			[Total Workload (Hours) / 25*] = **ECTS**	7

**25 hour workload is accepted as 1 ECTS*

Learning Outcomes	
1	Analyze the Klein-Gordon and the Dirac equations.
2	Know Maxwell's equations and classical Yang-Mills theory.
3	Kuantize Klein-Gordon, Dirac, and Majorana fields as well as formulate the Lagrangian for these fields.
4	Use perturbation theory in simple quantum field theories.
5	Derive Feynman rules from simple quantum field theories as well as interpret Feynman diagrams.

Programme Outcomes *(Physics Doctorate)*	
1	
2	
3	
4	
5	
6	
7	
8	

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	5	5	5	5	5
P3	5	5	5	5	5
P4	5	5	5	5	5
P5	5	5	5	5	5
P6	5	5	5	5	5
P7	5	5	5	5	5
P8	5	5	5	5	5