AYDIN ADNAN MENDERES UNIVERSITY
COURSE INFORMATION FORM

Course Title	Atom Molecule Physics								
Course Code	FİZ437		Couse Level	First Cycle (Bachelor's Degree)					
ECTS Credit	7	Workload	168 *(Hours)*	Theory	4	Practice	0	Laboratory	0
Objectives of the Course	To teach structure of atom and molecules, energy levels, wave functions, electromagnetic transitions, atomic and molecular spectroscopy.								
Course Content	Solutions of central field in hydrogen atom, some terms of Atomic Hamiltonian, Atomic spectroscopy, Application of perturbation theory to atomic physics, molecular physics.								
Work Placement	N/A								
Planned Learning Activities and Teaching Methods	Explanation (Presentation), Discussion, Problem Solving								
Name of Lecturer(s)									

Assessment Methods and Criteria		
Method	Quantity	Percentage (%)
Midterm Examination	1	40
Final Examination	1	60
Assignment	1	10

Recommended or Required Reading	
1	Atomic and Molecular Physics, Erol Aygün, Mehmet Zengin, 2009.
2	Physics of Atom and Molecules, B. H. Bransden and C. J. Joachain, 2003.
3	Atom, Molecul and Nucleus, Cemil Şenvar, 1982.

Week	Weekly Detailed Course Contents	
1	Theoretical	Solution of the Schrödinger equation for hydrogen atom
2	Theoretical	Wave functions and energy levels of hydrogen atom, orbitals
3	Theoretical	Dirac representation of wave functions
4	Theoretical	Expectation values, Virual theorem, Pauli spin matrix
5	Theoretical	Zeeman effect, spin-orbital interaction (fine structure)
6	Theoretical	Magnetic dipol-dipol interaction (Hyperfine structure)
7	Theoretical	Stark effect, selection rules, Clebsch-Gordon coefficients
8	Intermediate Exam	Midterm Exam
9	Theoretical	Atomic spectroscopy, spectra of sodium, X-ray spectroscopy, Hund rules
10	Theoretical	Spectrum of Helium, the Lamp shift, magnetic resonance
11	Theoretical	Time-independent perturbation theory
12	Theoretical	Time-dependent perturbation theory
13	Theoretical	Molecular physics, binding energy of molecules
14	Theoretical	Spectra of molecules with two atoms
15	Theoretical	Electronic radiation

Workload Calculation				
Activity	Quantity	Preparation	Duration	Total Workload
Lecture - Theory	14	4	4	112
Assignment	1	6	1	7
Midterm Examination	1	20	2	22
Final Examination	1	25	2	27
			Total Workload (Hours)	168
			[Total Workload (Hours) / 25*] = **ECTS**	6.5
**25 hour workload is accepted as 1 ECTS*				

Learning Outcomes	
1	To solve the Schrödinger equation for hydrogen atom
2	To learn Dirac presentation of wave functions
3	To learn some terms of Atomic Hamiltonian
4	To learn Atomic Spectroscopy
5	To apply perturbation theory to atomic physics
6	To learn molecular structure and molecular spectroscopy

Programme Outcomes *(Physics)*	
1	To understand the importance of physics by understanding the general concepts of physics, matter and energy
2	To be able to define the movements of matter and to distinguish the characteristics of movements under different force (potential)
3	Be able to say the meaning of Lagrange and Hamiltonian formulations of the movement and apply them to simple problems,
4	To be able to express the fundamental concepts such as time, space, force, momentum and energy in the movements of matter close to the speed of light and be able to solve and interpret the simple problems related to
5	To be able to establish the relationship between electric and magnetic forces and to be able to illustrate their applications to technology and solve problems related to the movement of particles in electric and magnetic fields
6	Be able to say the basic laws of electromagnetics and apply them to problems, illustrate their applications to simple technology
7	To be able to tell the reasons of the differences between the classical cases and the quantum scale and explain the reasons
8	Explain the concepts of discontinuity, uncertainty, matter-antimatter, indecisiveness of quantum physics with examples and explain simple problems related to the subject.
9	To be able to solve the problems of micro-particles under different simple potentials and be able to say their meanings
10	To be able to establish the relationship between the movements and properties of multi-particle systems and the laws of probability and solve simple problems
11	To be able to illustrate the laws, meanings and applications of thermodynamics and use them
12	Be able to use their knowledge about quantum physics and mechanics in explaining some properties of atoms and nuclei
13	To be able to show the meanings of some theoretical concepts by experimenting, and develop a strong relationship between thought and the real world, develop analytical thinking
14	To be able to apply the meanings of the basic laws of physics, their comprehension of universality and the relations between them and the unity of the laws of nature.
15	Use computer to solve physics problems
16	To be able to understand the problems by using their analytical knowledge skills and to propose solutions by dealing with the laws of physics
17	Be able to use the knowledge of physics to understand new technologies
18	To be able to tell the relations between symmetry and conservation laws in laws of physics

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

	L1	L2	L3	L4	L5	L6
P7	5	5				
P8	4	4	4	4	4	4
P12			5	5	5	5