

Course Code	Course Name	Teorical	Practice	Laboratory	Credits	ECTS
FZK-3038	Introduction to Atom and Molecular Physics	3.00	0.00	0.00	3.00	6.00
Course Detail						
Course Language	: Turkish					
Qualification Degree	: Bachelor					
Course Type	: Optional					
Preconditions	: Not					
Objectives of the Course	: This course deals with the structure and interactions of atoms and molecules, This course provide to understanding of approximate methods for atomic and molecular structure calculations					
Course Contents	: One electron atoms, energy states, probability dissociations of electron in atoms, fine structure, hyperfine structure, Zeeman effect Stark effect, Pauli's exclusion principle, many electron atoms, LS- and JJ-couplings, Hund rules, molecular structure, electronic structure of diatomic molecules					
Recommended or Required Reading	: 1) Atoms, Molecules and Photons, Wolfgang Demtröder (An Introduction to Atomic-, Molecularand Quantum-Physics), Springer Berlin Heidelberg New York. 2) Bransden, B.H., Joachain, C.J. (1983). Physics of Atoms and Molecules. London: Langman Grp.Lmt. 3) Aygün, E., Zengin, D. M. (1992). Atom ve Molekül Fiziği. Ankara: Bilim yayınevi.					
Planned Learning Activities and Teaching Methods	: Computer, Lecture, Homework					
Recommended Optional Programme Components	: Current research topics for students					
Instructors	: Assoc. Prof. Dr. Murat Ertürk					
Instructor's Assistants	: Assoc. Prof. Dr. Murat ERTÜRK					
Presentation Of Course	: Face to face					

Course Outcomes

Upon the completion of this course a student :

- 1 Describe the basic concepts and models used to account for atomic structure and spectra, utilize them in solving typical problems from atomic physics, compare the results of model calculations with experimental data,
- 2 Explain the fundamental importance of the landmark experiments in atomic physics, perform them, interpret their results, and make presentation
- 3 Apply quantum mechanics to the analysis of atomic and molecular structure and spectra, and appreciate its power in describing the world of atoms
- 4 Formulate and interpret the problems on the basis of acquired knowledge in this course

Preconditions

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Weekly Contents					
	Teoretical	Practice	Laboratory	Preparation Info	Teaching Methods
1.Week	*The Concept of the Atom, Historical development				
2.Week	*Development of Quantum Physics: Blackbody Radiation, Wien's Law, Stefan–Boltzmann's Radiation Law, Planck's Radiation Law, Photoelectric Effect, Compton Effect, Wave and Particle Aspects of Light				
3.Week	*Matter Waves and Wave Functions, Heisenberg's Uncertainty Principle	*Matter Waves and Wave Functions, Heisenberg's Uncertainty Principle			
4.Week	*The Quantum Structure of Atoms, Atomic Spectra, Bohr's Atomic Model				
5.Week	*The Hydrogen Atom: Schrödinger Equation for One-electron Systems and their solutions				
6.Week	*Electron Spin, Spin-Orbit Coupling and Fine structure, The Normal Zeeman Effect, Anomalous Zeeman Effect, Hyperfine Structure				
7.Week	*Total Wave Function and Quantum Numbers, Term Assignment and Level Scheme, Lamb Shift				
8.Week		*Midterm exam			
9.Week	*Atoms with More Than One Electron: Approximation Models, Symmetry of the Wave Function, Energy Levels of the Helium Atom,				
10.Week	*The Model of Independent Electrons, Slater determinants	*The Model of Independent Electrons, Slater determinants			
11.Week	*The Hartree Method				
12.Week	*The Hartree–Fock Method, Configuration Interaction	*Theoretical Models for Multielectron Atoms, The Hartree–Fock Method			
13.Week	*Molecular Orbitals and LCAO Approximations, The Heitler–London Method, Electronic States of Diatomic Molecules				
14.Week	*Electronic, vibrational and rotational spectra of diatomic molecules				

Assesment Methods %
1 Final : 60.000
2 Vize : 20.000
3 Presentation/Seminar : 10.000
4 Research presentation : 10.000

ECTS Workload			
Activities	Count	Time(Hour)	Sum of Workload
Vize	1	3.00	3.00
Final	1	3.00	3.00
Attending lectures	14	2.00	28.00
Application / Practice	4	4.00	16.00
Laboratory	4	8.00	32.00
Research presentation	4	2.00	8.00
Theoretical Lecturing	14	4.00	56.00
Tartışmalı Ders	14	2.00	28.00
Presentation/Seminar	4	1.00	4.00
Total :			178.00
Sum of Workload / 30 (Hour) :			6
ECTS :			6.00

Program And OutcomeRelation

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11	P.O. 12	P.O. 13	P.O. 14	P.O. 15	P.O. 16	P.O. 17	P.O. 18	P.O. 19	P.O. 20	P.O. 21	P.O. 22	P.O. 23	P.O. 24
L.O. 1	5	4	4	4	4	4	4	3	4	4	2	2	4	5	4	4	3	0	0	0	0	0	0	0
L.O. 2	5	4	4	4	5	4	4	3	4	4	2	2	4	4	4	4	3	0	0	0	0	0	0	0
L.O. 3	5	5	4	4	5	5	5	3	4	4	2	2	5	4	4	4	3	0	0	0	0	0	0	0
L.O. 4	5	5	4	5	5	5	5	3	4	4	2	2	4	5	5	4	3	0	0	0	0	0	0	0

Ders/Program Çıktıları İlişkisi

P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11	P.O. 12	P.O. 13	P.O. 14	P.O. 15	P.O. 16	P.O. 17	P.O. 18	P.O. 19	P.O. 20	P.O. 21	P.O. 22	P.O. 23	P.O. 24	P.O. 2
5	5	4	5	5	5	4	3	4	4	4	4	5	5	5	4	3	4	5	5	4	5	5	0	0