Fizik Bölümü / PHYSICS /

Course Code	Course Name	Teorical	Practice	Laboratory	Credits	ECTS
FZK-4019	Atom and Molecules Physics	2.00	2.00	0.00	3.00	7.00

Course Detail

Course Language	:	Turkish
Qualification Degree	:	Bachelor
Course Type	:	Optional
Preconditions	:	Not
Objectives of the Course	:	To investigate structure of atoms and molecules and to understand of formation mechanisms of structures, to discuss the structure of molecules in polyatomic systems.
Course Contents	:	Basic Concepts of Quantum Mechanics, The Hydrogen Atom, Electron Configurations and Couplings of Angular Momenta, Excited Atomic States, Emission and Absorption of Electromagnetic Radiation by Atoms, Physical principal of Lasers, Diatomic Molecules, The Exact Solution for the Rigid H2+ Molecule, Electronic States of Diatomic Molecules, The Chemical Bond, Multipole Interaction, Rotation and Vibration of Diatomic Molecules, Spectra of Diatomic Molecules, Electronic States of Polyatomic 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 to use the theoretical knowledge about one electron atoms and molecules

2 to calculate the atomic and molecular properties with aproximate methods

3 To explain the spectra of atoms and molecules

4 Analyze the advance electronic structure methods and apply these methods in useful areas

Preconditions

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Weekly Contents

	Teorical	Practice	Laboratory	Preparation Info	Teaching Methods
1.Week	*The concept of the atom and molecule, Historical development				
2.Week	*One electron atoms				
3.Week	*Solution of the Radial Equation: Quantum Numbers and Wave Functions of the H Atom				
4.Week	*fine structure and hyperfine structure				
5.Week	*Consideration of the Electron Spin, The Pauli Principle, Energy Levels of the Helium Atom				
6.Week	*LCAO, self-consistent field (SCF) method				
7.Week	*Transition Probabilities, Einstein Coefficients, Transition Probabilities and Matrix elements				
8.Week		*Midterm exam			
9.Week	*Selection Rules for the Magnetic Quantum Number, Magnetic dipole transitions				
10.Week	*Independent Electron model, Slater determinants	*TheModel of Independent Electrons, Slater determinants			
11.Week	*The Hartree Method				
12.Week	*Electronic States of Diatomic Molecules, Electron Spins, Multiplicity and Fine Structure Splittings, Excited States of Molecules				
13.Week	*Spectra of Diatomic Molecules				
14.Week	*Electronic, vibrational and rotational spectra of diatomic molecules, Basic Principles of Spectroscopic Techniques				

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	8	2.00	16.00
Theoretical Lecturing	14	4.00	56.00
Tartışmalı Ders	14	2.00	28.00
Presentation/Seminar	4	1.00	4.00
Further Study	14	1.00	14.00
		Total :	200.00
		Sum of Workload / 30 (Hour) :	7
		ECTS :	7.00

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	4	4	3	4	5	4	5	2	3	4	3	4	3	4	5	5	0	0	0	0	0	0	0	0
L.O. 2	4	4	3	4	4	4	5	3	3	4	3	4	4	4	5	5	0	0	0	0	0	0	0	0
L.O. 3	5	4	4	4	4	4	3	2	3	4	4	4	5	5	5	4	0	0	0	0	0	0	0	0
L.O. 4	4	4	4	4	4	5	4	3	2	4	3	4	5	5	5	5	0	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	4	4	5	5	5	5	3	4	5	5	4	4	5	4	5	3	0	0	0	0	0	0	0	0