Course Information

COURSE INFORMATION

Course Title	Code	Semester	L+U Hour	Credits	ECTS
Molecular Physics I	FZ5019		3 + 0	3.0	7.5

Prerequisites	None
Language of Instruction	Turkish
Course Level	Second Cycle
Course Type	Elective
Mode of delivery	Face to face
Course Coordinator	Assist. Prof. Dr. Mustafa KURT
Instructors	Assist. Prof. Dr. Mustafa KURT Prof. Dr. Serhat ÖZDER
Assistants	
Course Objectives	Introduction to molecular structure, vibrational and rotational energies of molecules. Dipole transitions; electronic structure analysis of diatomic molecules, hybridization,useful methods of molecular calculations; spectroscopic methods and spectroscopic analysis of small molecules.
Course Content	1 : Introduction to molecular structure, rotational, vibrational and electronic spectra 2 : Electronic structure of molecules, Born-Oppenheimer approximation 3 : Electronic spectra of molecules 4 : Term diagrams of molecules 5 : Electronic structure of diatomic molecules and applications H2+ molecule 6 : Symmetry of electronic wave functions, electronic configuration 7 : Molecular orbital, United and separated atoms approximations 8 : LCAO approximation and application to one-electron systems 9 : Multi-electron systems and electronic structure 10 : Application to H2 molecule 11 : Modern ab initio methods, Hartree-Fock and configuration interaction methods 12 : Ab initio calculations in the electronic structure 13 : Potential curve of diatomic and polyatomic molecules and vibrational spectrum 14 : Spectrum of diatomic and polyatomic molecules
Course Learning Outcomes	1) understand electronic, vibrational and rotational motions of molecular systems and their applications 2) Have knowledge about modern electronic structural calculations. 3) Investigate to atomic models. 4) Understand the meaning of molecular spectroscopy 5) able to calculate for the atomic transition probabilities between levels.

WEEKLY COURSE CONTENT

Week	Topics	Teaching and Learning Methods and Techniques	Study Materials
1. Week	Introduction to molecular structure, rotational, vibrational and electronic spectra	Oral lectures with interactive	

Quick Access

Physics (Master)
- Qualification Awarded
- Level of Qualification
- Qualification Requirements and Regulations
- Specific Admission Requirements
- Recognition of Prior Learning
- Profile of the Program
- Program Key Learning Outcomes
- Occupational Profile of Graduates
- Access to Further Studies
- Course Structure & Credits
- Exam Regulations & Assessment & Grading
- Graduation Requirements
- Mode of Study
- Programme Director(or Equivalent)
- Evaluation Questionnaire
- TYYÇ

Course Information
- Course Information
- Weekly Course Content
- Resources
- Assessment
- Course Category
- CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES
- ECTS credits and course workload

		discussions, Homeworks, Applications	
2. Week	Electronic structure of molecules, Born-Oppenheimer approximation	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
3. Week	Electronic spectra of molecules	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
4. Week	Term diagrams of molecules	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
5. Week	Electronic structure of diatomic molecules and applications H2+ molecule	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
6. Week	Symmetry of electronic wave functions, electronic configuration	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
7. Week	Molecular orbital, United and separated atoms approximations	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
8. Week	LCAO approximation and application to one-electron systems	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
9. Week	Multi-electron systems and electronic structure	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
10. Week	Application to H2 molecule	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
11. Week	Modern ab initio methods, Hartree-Fock and configuration interaction methods	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
12. Week	Ab initio calculations in the electronic structure	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
13. Week	Potential curve of diatomic and polyatomic molecules and vibrational spectrum	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
14. Week	Spectrum of diatomic and polyatomic molecules	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	

15. Week	Review	Oral lectures with interactive discussions, Homeworks, ApplicationsLecture	
16. Week	Final Exam	Written Exam	

RESOURCES

Recommended Sources
Physics of Atoms and Molecules, B. H. Bransden, Charles Jean Joachain, Prentice Hall, 2003.., ISBN-13: 978-0582356924
Lecture Notes on Atomic and Molecular Physics by S. Erkoc and T. Uzer (Aug 1996) , ISBN-13: 978-9810228118
Lectures on Atomic Physics, Walter R. Johnson, ISBN-13: 978-3540680109

ASSESSMENT

Measurement and Evaluation Methods and Techniques		
Mid-term: %30 • Final exam: %50 • Quiz: %20		
In-Term Studies	**Quantity**	**Percentage**
Research&Project	1	40
Total	1	40
End-Term Studies	**Quantity**	**Percentage**
Final Exam	1	60
Total	1	60
Contribution Of In-Term Studies To Overall Grade		40
End-Term Studies		60
Total		100

COURSE CATEGORY

Course Category	Percentage
Area of pecialization Courses	% 80

CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES

Programme Outcomes	Contribution Level	DK1	DK2	DK3	DK4	DK5
PY1	5	5	5	3	5	4
PY2	5	5	5	4	5	3
PY3	5	5	5	5	2	3
PY4	5	5	5	5	3	5
PY5	4	4	4	4	2	3
PY6	3	3	3	0	0	0
PY7	4	4	4	4	4	4
PY8	3	3	3	3	4	3
PY9	3	3	3	3	4	3
PY10	2	2	2	3	2	1
PY11	3	3	3	3	2	2

PY12	4	4	4	3	4	3
PY13	5	5	5	5	5	5
PY14	4	4	4	3	4	4
PY15	1	1	1	1	1	1

*DK = Course's Contrubution.

	0	1	2	3	4	5
Level of contribution	None	Very Low	Low	Fair	High	Very High

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ECTS CREDITS AND COURSE WORKLOAD

Event	Quantity	Duration (Hour)	Total Workload (Hour)
Final Exam	1	3	3
Class Hours (14 weeks)	14	3	42
Further Study	14	3	42
Mid Term Exam 1	1	3	3
Assignment 1	1	10	10
Application/Practice	1	16	16
Final Exam Preparation	1	25	25
Assignment 2	1	10	10
Research&Project	1	20	20
Mid Term Exam Preparation	1	20	20
		Total Workload	191
		Total Workload / 25.5 (s)	7.49
		ECTS Credit of the Course	7