Course Information

COURSE INFORMATION

Course Title	Code	Semester	L+U Hour	Credits	ECTS
Group Theory And Applications In Physics I	FZ5013		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	Prof. Dr. İsmail TARHAN
Instructors	Assist. Prof. Dr. Melis ULU DOĞRU
Assistants	
Course Objectives	The main objective of this course is to provide knowledge about permutation symmetry of electrons of atoms and molecules, anti-symmetric determinant wave function, geometrical symmetry of atom and molecules, properties of geometrical symmetry processes, definition of group, multiplication table of D3 group, direct product, classification of group elements, isomorphism and homomorphism properties of groups, Abelian and non-Abelian point groups, determination methods of molecular-point-groups, matrix representations of point groups, Euler angles, Euler notation of symmetry processes, function spaces of point groups. Reducible - irreducible representations and character tables, molecular vibrations.
Course Content	The main topics of the course intent are symmetry and natural sciences , symmetry elements and operations, definition of group, point groups, classification of point groups, determination of molecular point groups, reducible representations, unitary representations, irreducible representations and character tables, construction of character tables, the great orthogonality theorem, group theory and quantum mechanics, symmetry aspects of molecular orbital theory, Hartree-Fock theory , LCAO approximation, transformation properties of atomic orbital, Hybrid orbitals, orbital energy, hückel molecular orbital method, molecular vibration, the symmetry of normal vibrations, selection rules for fundamental vibrational transitions.
Course Learning Outcomes	1) Explain symmetry operations in the examination of molecules professionally 2) Describe symmetry elements of molecules. 3) Apply on molecular orbital theory. 4) Interpret character tables of the molecules. 5) Write irreducible representations and character tables.

WEEKLY COURSE CONTENT

Week	Topics	Teaching and Learning Methods and Techniques	Study Materials

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
- Course Category
- CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES
- ECTS credits and course workload

1. Week	Symmetry and natural sciences	Oral lectures with interactive discussions, Homeworks, Applications	
2. Week	Symmetry elements and operations	Oral lectures with interactive discussions, Homeworks, Applications	
3. Week	Definition of group, point groups, classification of point groups	Oral lectures with interactive discussions, Homeworks, Applications	
4. Week	Determination of molecular point groups	Oral lectures with interactive discussions, Homeworks, Applications	
5. Week	Reducible representations, unitary representations	Oral lectures with interactive discussions, Homeworks, Applications	
6. Week	Irreducible representations and character tables	Oral lectures with interactive discussions, Homeworks, Applications	
7. Week	Construction of character tables,	Oral lectures with interactive discussions, Homeworks, Applications	
8. Week	Mid-Term Exam	Written Exam	
9. Week	The Great orthogonality theorem	Oral lectures with interactive discussions, Homeworks, Applications	
10. Week	Group theory and quantum mechanics	Oral lectures with interactive discussions, Homeworks, Applications	
11. Week	Symmetry aspects of molecular orbital theory, Hartree-Fock theory	Oral lectures with interactive discussions, Homeworks, Applications	
12. Week	LCAO approximation, transformation properties of atomic orbital	Oral lectures with interactive discussions, Homeworks, Applications	
13. Week	Hybrid orbitals, orbital energy	Oral lectures with interactive discussions, Homeworks, Applications	
14. Week	Hückel molecular orbital method	Oral lectures with interactive discussions, Homeworks, Applications	
15. Week	Molecular vibration, the symmetry of normal vibrations, selection rules for fundamental vibrational transitions	Oral lectures with interactive	

		discussions, Homeworks, Applications	
16. Week	Final Exam	Written Exam	

RESOURCES

Recommended Sources
1) Chemical Applications of Group Theory, F. Albert Cotton, Wiley SE.
2) Group theory and Quantum mechanics, M. Tinkham

ASSESSMENT

Measurement and Evaluation Methods and Techniques
Mid-term exam + Assignment + Research & Project and Presentation 40%, Final Exam 60%

COURSE CATEGORY

Course Category	Percentage
Support Courses	% 100

CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES

Programme Outcomes	Contribution Level	DK1	DK2	DK3	DK4	DK5
PY1	4	4	4	4	5	4
PY2	4	5	5	5	5	5
PY3	4	4	4	4	4	4
PY4	3	5	4	5	5	3
PY5	4	4	4	4	4	3
PY6	4	4	4	4	4	3
PY7	5	5	5	4	4	4
PY8	4	4	4	4	4	4
PY9	4	5	5	4	4	4
PY10	4	4	3	4	4	4
PY11	4	4	4	4	4	4
PY12	4	4	5	4	4	4
PY13	5	5	4	5	5	5
PY14	4	4	4	4	4	4
PY15	4	4	3	5	5	4

*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)
Class Hours (14 weeks)	14	3	42

Final Exam Preparation	1	10	10
Mid Term Exam Preparation	1	10	10
Further Study	12	4	48
Assignment 1	10	4	40
Application/Practice	11	3	33
Final Exam	1	3	3
Presentation/Seminar	1	3	3
Mid Term Exam 1	1	3	3
Total Workload			192
Total Workload / 25.5 (s)			7.53
ECTS Credit of the Course			8