Form: Course Syllabus	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	06

1.	Course Title	Chemical Applications of Group Theory
2.	Course Number	0333721
3.	Credit Hours (Theory, Practical)	3
	Contact Hours (Theory, Practical)	3/week (Theory)
4.	Prerequisites/ Corequisites	None
5.	Program Title	MSc in chemistry
6.	Program Code	0333
7.	School/ Center	Science
8.	Department	Chemistry
9.	Course Level	MSc
10.	Year of Study and Semester (s)	2024, First
11.	Other Department(s) Involved in Teaching the Course	None
12.	Main Learning Language	
13.	Learning Types	☒Face to face learning ☐Blended ☐Fully online
14.	Online Platforms(s)	☐Moodle ☐Microsoft Teams
15.	Issuing Date	04/11/2023
16.	Revision Date	11/11/2024

17. Course Coordinator:

Name: Dr. Hazem Amarne Contact hours: Sun.+Tue. (1:30-2:30)/ Mon.+Wed. (1:00-2:00)

Office number: Chemistry Annex Rm. 417 Phone number: 22182

E-mail: h.amarne@ju.edu.jo

18. Other Instructors:

Name: Office number: Phone number: Email: Contact hours: Name: Office number: Phone number: Email: Contact hours:

19. Course Description:

Basic principles of group theory and its main applications; Theorems of group theory; Molecular symmetry and symmetry groups; Representation of groups; Group theory and quantum mechanics; Reducible and irreducible representations; Character tables; Direct products; Symmetry adapted linear combinations; Projection operators; Symmetry aspects of molecular orbital theory; Hybrid and molecular orbitals; Ligand field theory; Molecular vibrations; Applications in electronic and vibrational spectroscopy.

20. Program Student Outcomes (SO's): (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

SO1. Demonstrate comprehensive knowledge and understanding of chemistry topics, achieving expertise in foundational research principles.

SO2. Develop independent research skills to solve complex problems, focusing on analytical and critical thinking.

SO3. Improve communication of scientific knowledge through structured reports, presentations, and discussions.

SO4. Engage in activities that enhance practical scientific skills and improve professional expertise.

SO5. Maintain ethical standards in research.

21. Course Intended Learning Outcomes (CLO's): (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Understand the principles of symmetry and group theory in chemistry

Apply group theory to solve chemical problems related to molecular structure and bonding
3. Analyze molecular vibrations and their implications in vibrational spectroscopy using group theory
4. Synthesize knowledge of group theory in the context of ligand field theory and its applications

Course CLOs	The learning levels to be achieved					
	Remembering	**Understanding**	**Applying**	**Analysing**	**evaluating**	**Creating**
1		✓				
2			✓			
3				✓		
4				✓		
5		✓				

22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program SO's / Course CLO's	SO (1)	SO (2)	SO (3)	SO (4)	SO (5)	SO (6)	SO (7)
CLO (1)	✓						
CLO (2)		✓	✓	✓			
CLO (3)							
CLO (4)							

23. Topic Outline and Schedule:

1	1.1	Basic principles of group theory	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	1.2	Basic principles of group theory	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	1.3							
2	2.1	Basic principles of group theory	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	2.2	Basic principles of group theory	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	2.3							

3	3.1	Molecular symmetry and symmetry groups	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	3.2	Molecular symmetry and symmetry groups	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	3.3							
4	4.1	Molecular symmetry and symmetry groups	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	4.2	Molecular symmetry and symmetry groups	1 &2	FF			Quiz 1 & Final	Lecture notes & All References
	4.3							
5	5.1	Representation of groups	1 &2	FF			Midterm & Final	Lecture notes & All References
	5.2	Representation of groups	1 &2	FF			Midterm & Final	Lecture notes & All References
	5.3							
6	6.1	Representation of groups	1 &2	FF			Midterm & Final	Lecture notes & All References
	6.2	Character Tables	1 &2	FF			Midterm & Final	Lecture notes & All References
	6.3							
7	7.1	Group theory and quantum mechanics	1 &2	FF			Midterm & Final	Lecture notes & All References
	7.2	Symmetry adapted linear combinations	1 &2	FF			Midterm & Final	Lecture notes & All References
	7.3							
8	8.1	Symmetry adapted linear combinations	1 &2	FF			Midterm & Final	Lecture notes & All References
	8.2	Symmetry aspects of molecular orbital theory	1 &2	FF			Midterm & Final	Lecture notes & All References
	8.3							
9	9.1	Symmetry aspects of molecular orbital theory	1 &2	FF			Midterm & Final	Lecture notes & All References

	9.2	Symmetry aspects of molecular orbital theory	1 &2	FF			Midterm & Final	Lecture notes & All References
	9.3							
10	10.1	Symmetry aspects of molecular orbital theory	1 &2	FF			Quiz 2 & Final	Lecture notes & All References
	10.2	Hybrid and molecular orbitals	1 &2	FF			Quiz 2 & Final	Lecture notes & All References
	10.3							
11	11.1	Hybrid and molecular orbitals	1 &2	FF			Quiz 2 & Final	Lecture notes & All References
	11.2	Hybrid and molecular orbitals	1 &2	FF			Quiz 2 & Final	Lecture notes & All References
	11.3							
12	12.1	Ligand field theory	1 &2	FF			Final	Lecture notes & All References
	12.2	Ligand field theory	1 &2	FF			Final	Lecture notes & All References
	12.3							
13	13.1	Ligand field theory	1 &2	FF			Final	Lecture notes & All References
	13.2	Molecular vibrations	1 &2	FF			Final	Lecture notes & All References
	13.3							
14	14.1	Molecular vibrations	1 &2	FF			Final	Lecture notes & All References
	14.2	Molecular vibrations	1 &2	FF			Final	Lecture notes & All References
	14.3							
15	15.1							
	15.2							
	15.3							
16								

24. Evaluation Methods:

Opportunities to demonstrate the achievement of the CLOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	CLO/s Linked to the Evaluation activity	Period (Week)	Platform
Quiz 1	15	As per section 23	1 & 2	Week 5	Paper Exam
Midterm Exam	30	As per section 23	1 & 2	Week 10	Paper Exam
Quiz 2	15	As per section 23	1 & 2	Week 12	Paper Exam
Final Exam	40	As per section 23	1 & 2	Week 14-15	Paper Exam

25. Course Requirements:

Students should have a computer, internet connection, account on Microsoft Teams and Moodle.

26. Course Policies:

A- Attendance policies:

B- Absences from exams and submitting assignments on time:

C- Health and safety procedures:

D- Honesty policy regarding cheating, plagiarism, misbehavior:

E- Grading policy:

F- Available university services that support achievement in the course:

27. References:

A- Required book(s), assigned reading and audio-visuals:

(1) Chemical Applications of Group Theory, by F. Albert Cotton, 3rd Edition, WILEY, 1990.

B- Recommended books, materials, and media:

(2) Group Theory for Chemists, by George Davidson, 1st Edition, MACMILLAN education Ltd., 1991.

(3) Group Theory for Chemists: Fundamental Theory and Applications, by Kieran Molloy, 2nd Edition, WOODHEAD publishing, 2013.

28. Additional information:

Name of the Instructor or the Course Coordinator: **Dr. Hazem Amarne**	Signature: ……..……	Date: ……..……
The Head of Graduate Studies Committee/ Department Chemistry **Dr. Murad AlDamen, Prof.**	**Signature:** **……..……**	**Date:** **……..……**
The Head of Department of Chemistry **Dr. Murad AlDamen, Prof.**	**Signature:** **……..……**	**Date:** **……..……**
Vice Dean for Graduate Studies and Scientific Research / School of Science **Dr. Kamal Sweidan, Prof.**	**Signature:** **……..……**	**Date:** **……..……**
The Dean of School of Science **Dr. Mahmoud I. Jaghoub, Prof.**	**Signature:** **……..……**	**Date:** **……..……**