مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

Course Syllabus

1	**Course title**	Chemical Applications of Group Theory
2	**Course number**	0333721
3	**Credit hours**	3
	Contact hours (theory, practical)	Sun. and Tue. (3:30-5:00), Theory
4	**Prerequisites/corequisites**	None
5	**Program title**	MSc in chemistry
6	**Program code**	0333
7	**Awarding institution**	The University of Jordan
8	**School**	Science
9	**Department**	Chemistry
10	**Course level**	Master degree
11	**Year of study and semester(s)**	2023, First Semester
12	**Other department(s) involved in teaching the course**	None
13	**Main teaching language**	English
14	**Delivery method**	☒Face to face learning ☐Blended ☐Fully online
15	**Online platforms(s)**	☒Moodle ☒Microsoft Teams ☐Skype ☐Zoom ☐Others……
16	**Issuing/Revision Date**	04/11/2023

17 Course Coordinator:

Name: Dr. Hazem Amarne	Contact hours: Sun.+Tue. (1:30-2:30)/ Mon.+Wed. (2:00-3:00)
Office number: Chemistry Annex Rm. 417	Phone number: 22182
Email: 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.

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20 Course aims and outcomes:

A- Aims:

Student will learn how to use symmetry operations and how to classify molecules into point groups. Student will be able to apply group theory to vibrational spectroscopy and can determine the symmetry selection rules for infrared and Raman spectroscopy. Student will be able to understands how group theory is used in description of chemical bond and electronic spectroscopy.

B- Students Learning Outcomes (SLOs):

Upon successful completion of this course, students will be able to:

1. Understand the principles of symmetry and group theory related to chemistry
2. Use group theory principles to solve chemically related problems

SLOs / SLOs of the course	SLO (1)	SLO (2)	SLO (3)	SLO (4)
1				
2				
3				
4				
5				
6				

21. Topic Outline and Schedule:

Week	Lecture	Topic	Intended Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	Basic principles of group theory and	1	Face to Face			First exam	Lecture notes and All References

		its main applications						
	1.2	Theorems of group theory	1	Face to Face			First exam	Lecture notes and All References
2	2.1	Molecular symmetry and symmetry groups	1	Face to Face			First exam	Lecture notes and All References
	2.2	Molecular symmetry and symmetry groups	1	Face to Face			First exam	Lecture notes and All References
Week	**Lecture**	**Topic**	**Intended Learning Outcome**	**Learning Methods (Face to Face/Blended/ Fully Online)**	**Platform**	**Synchronous / Asynchronous Lecturing**	**Evaluation Methods**	**Resources**
3	3.1	Representation of groups	1	Face to Face			First exam	Lecture notes and All References
	3.2	Representation of groups	1	Face to Face			First exam	Lecture notes and All References
4	4.1	Representation of groups	1	Face to Face			First exam	Lecture notes and All References
	4.2	Representation of groups	1	Face to Face			First exam	Lecture notes and All

								References
5	5.1	Group theory and quantum mechanics	1	Face to Face			Second exam	Lecture notes and All References
	5.2	Symmetry adapted linear combinations	2	Face to Face			Second exam	Lecture notes and All References
6	6.1	Symmetry adapted linear combinations	2	Face to Face			Second exam	Lecture notes and All References
	6.2	Symmetry aspects of molecular orbital theory	2	Face to Face			Second exam	Lecture notes and All References
7	7.1	Symmetry aspects of molecular orbital theory	2	Face to Face			Second exam	Lecture notes and All References
	7.2	Symmetry aspects of molecular orbital theory	2	Face to Face			Second exam	Lecture notes and All References
8	8.1	Symmetry aspects of molecular orbital theory	2	Face to Face			Second exam	Lecture notes and All References

	8.2	Hybrid and molecular orbitals	2	Face to Face			Second exam	Lecture notes and All References
9	9.1	Hybrid and molecular orbitals	2	Face to Face			Second exam	Lecture notes and All References
	9.2	Ligand field theory	2	Face to Face			Final Exam	Lecture notes and All References
10	10.1	Ligand field theory	2	Face to Face			Final Exam	Lecture notes and All References
	10.2	Ligand field theory	2	Face to Face			Final Exam	Lecture notes and All References
11	11.1	Molecular vibrations	2	Face to Face			Final Exam	Lecture notes and All References
	11.2	Molecular vibrations	2	Face to Face			Final Exam	Lecture notes and All References
12	12.1	Molecular vibrations	2	Face to Face			Final Exam	Lecture notes and All

								References
	12.2	Molecular vibrations	2	Face to Face			Final Exam	Lecture notes and All References
13	13.1							
	13.2							
	13.3							
14	14.1							
	14.2							
	14.3							
15	15.1							
	15.2							
	15.3							

22 Evaluation Methods:

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

Evaluation Activity	**Mark**	**Topic(s)**	**SLOs**	**Period (Week)**	**Platform**
Quiz	15	As per Sec. 21 above		Week 7	none
Midterm Exam	30	As per Sec. 21 above		Week 12	none
Presentation	15	TBA		Week 14	
Final Exam	40	As per Sec. 21 above		Week 15	none

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23 Course Requirements

(e.g: students should have a computer, internet connection, account on a specific software/platform…etc):

24 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:

25 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.

26 Additional information:

Name of Course Coordinator: Dr. Hazem Amarne Signature: ---------- Date: 04/11/2023
Head of Curriculum Committee/Department: ---------- Signature: ----------
Head of Department: ---------- Signature: ----------
Head of Curriculum Committee/Faculty: ---------- Signature: ----------
Dean: ---------- Signature: ----------