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	Advanced Inorganic Chemistry
2.	Course Number	
3.	Credit Hours (Theory, Practical)	0303992
	Contact Hours (Theory, Practical)	
4.	Prerequisites/ Corequisites	3
5.	Program Title	Theory
6.	Program Code	none
7.	School/ Center	PhD
8.	Department	399
9.	Course Level	The university of Jordan
10.	Year of Study and Semester (s)	Science
11.	Other Department(s) Involved in Teaching the Course	Chemistry
12.	Main Learning Language	PhD
13.	Learning Types	First semester 2024/2025
14.	Online Platforms(s)	Microsoft Teams
15.	Issuing Date	English
16.	Revision Date	■Face to face learning ☐Blended ☐Fully online

17. Course Coordinator:

Name Prof Dr. Fawwaz I. Khalili
Contact hours:

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18. Other Instructors:

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This course consists of some modules that possibly can be expanded to more topics in the advances in inorganic chemistry:

1. Inorganic ion in solution

The study of ions in solution in inorganic chemistry involves analyzing solvation numbers, ion-solvent distances, and interactions using techniques like NMR, X-ray diffraction, UV-visible, IR, and Raman spectroscopy. This includes understanding hydrolysis, polymerization, and pK values related to acid-base behavior. Stability constants, chelation, and macrocyclic ligands are essential for determining ion stability in solutions. The field also covers redox potential and their thermodynamics, along with the kinetics of reactions, focusing on solvent exchange, complex formation, and substitution mechanisms. Additionally, redox reactions are explored through inner-sphere and outer-sphere mechanisms, with an emphasis on intermediates, metal ion oxidation, and electron transfer. This integrated approach deepens our understanding of the behavior and reactions of ions in various inorganic systems.

2. Frontiers in main-group catalysis

Knowledge obtained from previous courses using transition-metal based catalysis to form carbon-based molecules and materials will be expanded to main-group elements, where main-group compounds are the catalysts or substrates in the reactions.

3. Supramolecular chemistry

This module will expand the knowledge base in supramolecular chemistry to understand key aspects of substrate recognition from the perspective of underlying binding forces. These weak and reversible non-covalent interactions such as hydrogen bonds, hydrophobic forces, and metal-ligand coordination are key in understanding biological processes and self-assembling systems and constructing complex materials and molecular machinery.

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. Develop chemistry expertise, focus on theory and practice, and contribute to advancing knowledge in a specific research field.
SO2. Conduct original, high-quality research that advances knowledge in chemistry by developing complex projects using innovative methodologies.
SO3. Mentor junior researchers and students and demonstrate leadership in the scientific community through collaboration, peer review, and knowledge exchange.
SO4. Recognize the ethical implications and responsibly use chemistry solutions to tackle global challenges.
SO5. Participate in ongoing professional development to stay up to date with the latest research and innovations.

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

CLO 1. Describe in detail advanced inorganic chemistry relevant to the advanced topics.
CLO 2. Present and discuss literature relevant to the different topics covered in class.
CLO 3. Identify and describe cutting edge areas in inorganic chemistry.
CLO 4. Critically assess ideas and research at an advanced level.
CLO 5. Research, analyze and communicate research articles in inorganic chemistry.

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)
CLO (1)	√			√	
CLO (2)	√	√			√
CLO (3)	√	√		√	
CLO (4)	√	√	√	√	√
CLO (5)	√	√	√		√

23. Topic Outline and Schedule:

The following topics are listed regarding module 1

Week	Lecture	Topic	CLO/s Linked to the Topic	Fully Online (FO)	Platform Used		Evaluation Methods	Learning Resources
1	1.1	Introduction	**1,2**	**FF**			**Quiz 1 & Final**	**Lecture notes & All References**
	1.2	New aqua-metal ions	1,2					
	1.3							
2	2.1	NMR spectroscopy	1,2	**FF**			**Quiz 1 & Final**	**Lecture notes & All References**
	2.2	Solvation numbers	1,2					
	2.3							
3	3.1	Ion-solvent distances	1,2	**FF**			**Quiz 1 & Final**	**Lecture notes & All References**
	3.2	X-ray diffraction studies	1,2					
	3.3							
4	4.1	Ion-solvent interaction	1,2	**FF**			**Quiz 1 & Final**	Lecture notes & All References
	4.2	Thermochemistry of ion solvation.	1,2					
	4.3							
5	5.1	Acid-base behavior	1,2	**FF**			**Quiz 1 & Final**	Lecture notes & All References
	5.2	seminars	3,4,5					
	5.3							

6	6.1	Polymerization	1,2				**Quiz 1 & Final**	Lecture notes & All References
	6.2	seminars	3,4,5					
	6.3							
7	7.1	Stability constant	1,2	**FF**			**Final**	Lecture notes & All References
	7.2	seminars	3,4,5					
	7.3							
8	8.1	Encapsulating ligands	1,2	**FF**			**Final**	Lecture notes & All References
	8.2	Redox potentials	1,2				**Final**	
	8.3							
9	9.1	Kinetics and thermodynamics	1,2	**FF**			**Final**	Lecture notes & All References
	9.2	Seminar	3,4,5					
	9.3							
10	10.1	Solvent exchange	1,2	**FF**			**Final**	Lecture notes & All References
	10.2	Seminar	3,4,5					
	10.3							
11	11.1	Complex formation	1,2	**FF**			**Final**	Lecture notes & All References
	11.2	Seminar	3,4,5					
	11.3							
12	12.1	Chelate formation	1,2	**FF**			**Final**	Lecture notes & All References
	12.2	Seminar	3,4,5					
	12.3							
13	13.1	Substitution at complex ions	1,2	**FF**			**Final**	Lecture notes & All References
	13.2	Seminar	3,4,5					
	13.3							
14	14.1	Redox reactions	1,2	**FF**			**Final**	
	14.2	Outer-sphere mechanism	3,4,5					
	14.3							
15	15.1	Final exam	1,2,3,4					
	15.2							
	15.3							

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
Midterm Exam	30	1-6	1,2	8	Paper exam
seminars	30		3,4,5		oral
Final	40	all	1,2,3,4	16	Paper exam

25. Course Requirements:

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

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 :

last module taught
A- Required book(s), assigned reading and audio-visuals:
Ions in Solution 2nd Ed
J. Burgess
Horwood Publishing Co
B- Recommended books, materials, and media:
Several papers related to the material covered

28. Additional information:

Name of the Instructor or the Course Coordinator: Prof Fawwaz I. Khalili	Signature:	Date: 11/14/2024
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:** ……..……