

## Course Syllabus

1	<b>Course title</b>	Advanced Inorganic Chemistry	
2	<b>Course number</b>	0303992	
3	<b>Credit hours</b>	3	
	<b>Contact hours (theory, practical)</b>	<b>Theory</b>	
4	<b>Prerequisites/corequisites</b>	none	
5	<b>Program title</b>	PhD	
6	<b>Program code</b>	399	
7	<b>Awarding institution</b>	The university of Jordan	
8	<b>School</b>	Science	
9	<b>Department</b>	Chemistry	
10	<b>Course level</b>	PhD	
11	<b>Year of study and semester (s)</b>	Third year/ First <b>semester</b>	
12	<b>Other department (s) involved in teaching the course</b>	None	
13	<b>Main teaching language</b>	English	
14	<b>Delivery method</b>	<input checked="" type="checkbox"/> Face to face learning <input type="checkbox"/> Blended <input type="checkbox"/> Fully online	
15	<b>Online platforms(s)</b>	<input type="checkbox"/> Moodle <input type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom <input type="checkbox"/> Others.....	
16	<b>Issuing/Revision Date</b>	7/11/2023	

### 17 Course Coordinator:

Name: Prof Dr. Fawwaz I. Khalili

Office number: 25

Phone number: 22142

Email: fkhalili@ju.edu.jo

Contact hours: 12-1 Sunday, Tuesday

**18 Other instructors:**

Name:

Office number:

Phone number:

Email:

Contact hours:

Name:

Office number:

Phone number:

Email:

Contact hours:

**19 Course Description:**

As stated in the approved study plan.

**1. Introduction**

Dissolution of salts, Metal ions around the periodic Table, New aqua-metal ions, Anions and complexes in solution, Model for ions in solution.

**2. Solvation numbers**

NMR spectroscopy, Ion movement methods, Review of solvation numbers.

**3. Ion-solvent distances**

X-ray diffraction by solutions, Radial distribution functions, Results of diffraction and scattering studies.

**4. Ion-solvent interaction**

Ultraviolet – visible spectroscopy, IR and Raman spectroscopy, Thermochemistry of ion solvation.

5. **Acid-base behavior: hydrolysis and polymerization**

pK values for aqua-metal ions, Polymerization, Anions and ligands, Complexes.

6. **Stability constant**

Definitions, Trends, Chelates, Selectivity; macro cyclic and encapsulating ligands, Relevance.

7. **Redox potentials**

Introduction and thermodynamics, Aqua-metal ions, Complexes, Redox potentials and stability constants.

8. **Kinetics and thermodynamics.**

9. **Kinetics and mechanisms: solvent exchange**

Introduction, Mechanisms, Reactivates.

10. **Kinetics and mechanisms: complex formation**

Background, The Eigen-Wilkins mechanism, Chelate formation, Polydentate and macrocyclic ligands, Crown ethers and cryptand.

11. **Kinetics and mechanisms: substitution at complex ions** General, Cobalt(III) complexes, Platinum(II) complexes,

Pentacyanoferrates(II), Other complexes.

12. **Kinetics and mechanisms: redox reactions**

Introduction, The inner-sphere mechanism, The outer-sphere mechanism Intermediates, pre-equilibria, and other complications, Metal ion oxidation of simple species, Oxoanion oxidants, Intermolecular electron transfer.

## 20 Course aims and outcomes:

A- Aims: To learn everything that is related to ions in solution and their behavior

B- Students Learning Outcomes (SLOs):

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

SLOs SLOs of the course	SLO (1)	SLO (2)	SLO (3)	SLO (4)
1 Ions in solution	Nature of solvation	Solvation numbers	Ion-solvent distances	Ion-solvent interaction
2 Behavior of ions	Acid-base	Hydrolysis and polymerisation	Stability constant	Redox potentials
3 Kinetics and thermodynamics	Solvent exchange	Complex formation	Substitution	Redox reactions
4				
5				
6				

## 21. Topic Outline and Schedule:

Week	Lecture	Topic	Student Learning Outcome	Learning Methods (Face to Face/Blended/ Fully Online)	Platform	Synchronous / Asynchronous Lecturing	Evaluation Methods	Resources
1	1.1	Introduction						
	1.2	New aqua-metal ions						

	1.3							
2	2.1	NMR spectroscopy						
	2.2	Solvation numbers						
	2.3							
3	3.1	Ion-solvent distances						
	3.2	X-ray diffraction studies						
	3.3							
4	4.1	Ion-solvent interaction						
	4.2	Thermo chemistry of ion solvation.						
	4.3							
5	5.1	Acid-base behavior						
	5.2	seminars						
	5.3							
6	6.1	Polymerization						
	6.2	seminars						
	6.3							
7	7.1	Stability constant						
	7.2	Seminar						
	7.3							
8	8.1	encapsulating ligands						

	8.2	Redox potentials						
	8.3							
9	9.1	Kinetics and thermodynamics						
	9.2	Seminar						
	9.3							
10	10.1	Solvent exchange						
	10.2	Seminar						
	10.3							
11	11.1	Complex formation						
	11.2	Seminar						
	11.3							
12	12.1	Chelate formation						
	12.2	Seminar						
	12.3							
13	13.1	Substitution at complex ions						
	13.2	Seminar						
	13.3							
14	14.1	Redox reactions						
	14.2	Outer-sphere mechanism						
	14.3							
15	15.1	Final exam						
	15.2							

	15.3							
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## 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
Mid Term:	30%	Chapter 1 to 6		sixth	Written exam
Papers Seminar:	30%	Topics and seminars related to theory		Started from week five	Oral presentation
Final Exam:	40%	All the chapters covered		During finals	Written exam

## 23 Course Requirements

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

## 24 Course Policies:

- A- Attendance policies: According to university rules
- B- Absences from exams and submitting assignments on time: Not applicable
- C- Health and safety procedures: Not applicable
- D- Honesty policy regarding cheating, plagiarism, misbehavior: According to university rules



E- Grading policy: Very clear and exam papers will be returned to students after correction

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

## 25 References:

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

Ions in Solution 2nd Ed

J. Burgess

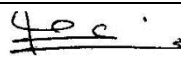
Horwood Publishing Co

B- Recommended books, materials, and media:

Several papers related to the material covered

## 26 Additional information:

Name of Course Coordinator: Prof Fawwaz I. Khalili

Signature:  Date: 8/11/2023

Head of Curriculum Committee/Department: ----- Signature: -----

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مركز الاعتماد  
و ضمان الجودة  
ACCREDITATION & QUALITY ASSURANCE CENTER

Head of Department: ----- Signature: -----  
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Head of Curriculum Committee/Faculty: ----- Signature: -----  
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Dean: ----- Signature: -----