مركز الاعتماد وضمان الجودة
ACCREDITATION & QUALITY ASSURANCE CENTER

Course Syllabus

1	**Course title**	Inorganic Chemistry (I)
2	**Course number**	0303221
3	**Credit hours**	3 (theory)
	Contact hours (theory, practical)	3 hrs/week (theory)
4	**Prerequisites/corequisites**	General Chemistry (2), 0303102
5	**Program title**	B.Sc. Chemistry
6	**Program code**	0303
7	**Awarding institution**	The University of Jordan
8	**School**	Science
9	**Department**	Chemistry
10	**Course level**	Second Year
11	**Year of study and semester(s)**	First semester 2023/2024
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**	03-11-2023

17 Course Coordinator:

Name: Prof. Dr. Murad A. AlDamen	Contact hours: 8:00-10:00 Mon. Wed.
Office number: Chemistry 2nd floor	Phone number: N/A
Email: maldamen@ju.edu.jo	

18 Other instructors:

Name: Dr. Hazem Amarne
Office number:
Phone number:
Email:

19 Course Description:

Fundamental particles of an atom, Bohr's theory; success in early quantum theory, an introduction to wave mechanics; atomic orbitals; quantum numbers; many-electron atoms; effective nuclear charge and Slater's rules; Hund's rule; *Aufbau* principle; ionization energies and electron affinities; Lewis bonding theory; valance bond theory (VB); molecular orbital theory (MO); octet rule and isoelectronic species; electronegativity and dipole moments; VSEPR model; stereoisomers; hybridization; structures and energies of metallic and ionic solids; packing of spheres; polymorphism in metals; alloys and intermetallic compounds; bonding in metals and semiconductors; Schottky and Frenkel defect; band theory and Fermi level; ionic lattices; lattice energy; Born-Haber cycle; Kapustinskii equation; acids, bases and ions in aqueous solution; solubility of ionic salts; energetics of dissolution of ionic salts; properties of water; Brønsted acids and bases; Hard/Soft Acid/Base Theory (HSAB); introduction to coordination complexes.

20 Course aims and outcomes

A- Aims:

The aims of chapters 1 & 2 are to outline some concepts fundamental to an understanding of inorganic chemistry. Although, it has been assumed that students are to some extent familiar with most of these concepts as they have been taken them in chemistry I and II, we will resume them upon necessity. In chapter 4. Molecular orbital theory uses the methods of group theory to describe the bonding in molecules and complements and extends the simple pictures of bonding introduced in chapter 2. Two theories will be discussed and presented (Valence bond theory (VBT) and Molecular orbital theory (MOT)). These molecular orbitals are then filled with the available electrons according to the same rules used for atomic orbitals, and the total energy of the electrons in the molecular orbitals is compared with the initial total energy of electrons in the atomic orbitals and so we need to remember the basics (chapters 1 & 2). To complete the image, we need to study the medium in inorganic chemistry. The importance of water as medium for inorganic reactions stems not only from the fact that it is far more readily available than any other solvent, but also because of the abundance of accurate physiochemical data for aqueous solutions compared with the relative scarcity of such data for solutions in other solvents, acids, bases, and other facts about aqueous medium will be introduced in chapter 7. Although many inorganic reactions take place in aqueous solution, water is not always a suitable solvent. The medium in which the solvent is not water is called non-aqueous medium and will be introduced in chapter 9. Finally, this course, as well as other inorganic course (303321 and 303322), will also introduce, through readings from the primary literature and secondary sources, some areas of research currently interesting to inorganic chemists, such as organometallic chemistry, bioinorganic chemistry, main group chemistry, clusters chemistry, supramolecular chemistry, and material sciences.

B- Students Learning Outcomes (SLOs):

The program's student outcomes must fulfill the above ABET student outcomes. You can add new outcomes for your program, but all the six ABET-outcomes must be included.

SO-1. Problem Solving: Graduates will be able to apply mathematical and scientific knowledge to identify, formulate, and solve technical or scientific problems relevant to the discipline of chemistry.
SO-2. Design: Graduates will be able to use their understanding of chemistry concepts and principles to formulate and design systems, processes, procedures, or programs to meet desired goals and outcomes.
SO-3. Experimental Skills: Graduates will be able to design, conduct, and analyze experiments or test hypotheses, utilizing appropriate chemical techniques and scientific judgment to draw meaningful conclusions.
SO-4. Communication: Graduates will be able to communicate scientific information effectively and accurately to a range of audiences, including both technical and non-technical audiences.
SO-5. Ethics and Global Context: Graduates will understand and apply ethical and professional responsibilities in the context of the impact of technical and scientific solutions on global, economic, environmental, and societal issues.
SO-6. Teamwork: Graduates will be able to work effectively as part of a team, establishing goals, planning tasks, meeting deadlines, and analyzing risk and uncertainty in the context of chemistry-related projects and initiatives.
SO-7. Handling Chemicals: An ability to apply the proper procedures for safe handling of chemicals.

Table 1: Mapping of student outcomes (SOs) with ABET listed student outcomes							
		ABET student outcomes					
Our current student outcomes	SO#	1	2	3	4	5	6
	SO-1	✓					
	SO-2		✓				
	SO-3			✓			
	SO-4				✓		
	SO-5					✓	
	SO-6						✓
	SO-7						

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	The hydrogen atom	1	**Face to face**			First exam	Housecroft Chapter 1

	1.2	The radial wave function	1	**Face to face**			First exam	Housecroft Chapter 1
	1.3	The angular wave function	1	**Face to face**			First exam	Housecroft Chapter 1
2	2.1	Symmetry of orbitals	1	**Face to face**			First exam	Housecroft Chapter 1
	2.2	Energies of orbitals	1	**Face to face**			First exam	Housecroft Chapter 1
	2.3	The poly electronic atoms	1	**Face to face**			First exam	Housecroft Chapter 1
3	3.1	Electron spin and Pauli principle	1	**Face to face**			First exam	Housecroft Chapter 1
	3.2	The Aufbau principle	1	**Face to face**			First exam	Housecroft Chapter 1
	3.3	Atomic states and Hund's rule.	1	**Face to face**			First exam	Housecroft Chapter 1
4	4.1	Periodicity of the elements.	1	**Face to face**			First exam	Housecroft Chapter 1
	4.2	Shielding	1	**Face to face**			First exam	Housecroft Chapter 1

	4.3	The sizes of atoms	1	**Face to face**			First exam	Housecroft Chapter 1
5	5.1	Ionization energy	1	**Face to face**			First exam	Housecroft Chapter 1
	5.2	Lewis structures	1	**Face to face**			First exam	Housecroft Chapter 2
	5.3	Basics of VB Theory	1	**Face to face**			First exam	Housecroft Chapter 2
6	6.1	VB Theory applications	1	**Face to face**			First exam	Housecroft Chapter 2
	6.2	Basics of MO Theory	1	**Face to face**			First exam	Housecroft Chapter 2
	6.3	MO of diatomic molecules and ions	1	**Face to face**			First exam	Housecroft Chapter 2
7	7.1	Electronegativity: Pauling, Mulliken, and Allred–Rochow methods	1	**Face to face**			First exam	Housecroft Chapter 2
	7.2	Dipole moments and partial charge calculations	1	**Face to face**			First exam	Housecroft Chapter 2

	7.3	VSEPR theory	1	**Face to face**			First exam	Housecroft Chapter 2
8	8.1	Determination of molecular geometries based on VSEPR theory	1	**Face to face**			First exam	Housecroft Chapter 2
	8.2	Stereoisomers concepts	1	**Face to face**			Second exam	Housecroft Chapter 2
	8.3	Determination of stereoisomers of inorganic compounds	1	**Face to face**			Second exam	Housecroft Chapter 2
9	9.1	Hybridization of poly atomic molecules	1	**Face to face**			Second exam	Housecroft Chapter 5
	9.2	Orthogonality and normalization	1	**Face to face**			Second exam	Housecroft Chapter 5
	9.3	Directionality in bond formation	1	**Face to face**			Second exam	Housecroft Chapter 5
10	10.1	π-Bonding inVBT	1	**Face to face**			Second exam	Housecroft Chapter 5
	10.2	Structure of crystal lattices	2	**Face to face**			Final exam	Housecroft Chapter 6

	10.3	Efficiency of packing in crystal lattices	2	**Face to face**			Final exam	Housecroft Chapter 6
11	11.1	Structure of ionic solids	2	**Face to face**			Final exam	Housecroft Chapter 6
	11.2	Calculation of the number of atoms in different unit cells	2	**Face to face**			Final exam	Housecroft Chapter 6
	11.3	Factors that influence the structure of ionic compounds	2	**Face to face**			Final exam	Housecroft Chapter 6
12	12.1	Polarizability effect on covalency	2	**Face to face**			Final exam	Housecroft Chapter 6
	12.2	Radius ratio rules	2	**Face to face**			Final exam	Housecroft Chapter 6
	12.3	Ketelaar Triangle	2	**Face to face**			Final exam	Shriver Chapter 2
13	13.1	Types of alloys	2	**Face to face**			Final exam	Housecroft Chapter 6
	13.2	Band theory and bonding in metals	2	**Face to face**			Final exam	Housecroft Chapter 6

	13.3	Rationalization of metal properties based on band theory	2	**Face to face**			Final exam	Housecroft Chapter 6
14	14.1	Metals, insulators, and semiconductors	2	**Face to face**			Final exam	Housecroft Chapter 6
	14.2	Calculations of the lattice energy of ionic compounds using electrostatic model equations	2	**Face to face**			Final exam	Housecroft Chapter 6
	14.3	Calculations of the lattice energy of ionic compounds using Born-Haber cycle	2	**Face to face**			Final exam	Housecroft Chapter 6
15	15.1	Factors that affect lattice enthalpies	2	**Face to face**			Final exam	Housecroft Chapter 6
	15.2	Energetics of dissolution of ionic compounds in water	2	**Face to face**			Final exam	Housecroft Chapter 7
	15.3	Effects of ionic size/charge on solubility	2	**Face to face**			Final exam	Housecroft Chapter 7
16	16.1	Effects of polarization on solubility	2	**Face to face**			Final exam	Housecroft Chapter 7

	16.2	Structure and hydrogen bonding of water	2	**Face to face**			Final exam	Housecroft Chapter 7
	16.3	Acid/base behaviour	2	**Face to face**			Final exam	Housecroft Chapter 7
	16.4	Rules governing the strength of oxoacids	2	**Face to face**			Final exam	Housecroft Chapter 7
	16.5	Hard/Soft Acid/Base Theory (HSAB)	2	**Face to face**			Final exam	Housecroft Chapter 7

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	20	As per Sec. 21 above		Week 8	
Midterm	30	As per Sec. 21 above		Week 12	
Final Exam	50	As per Sec. 21 above		TBD	

23 Course Requirements

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(Scientific calculator (Smart phones are not allowed) and writing utensils

24 Course Policies:

A- Attendance policies: All students are expected to follow the of attendance policies of the University of Jordan, absences exceeding 15% of total number of class meeting (6 hour classes) will result in F grade or course drop.

B- Absences from exams and handing in assignments on time: University rules and regulations regarding make-up exams.

C- Health and safety procedures: N/A

D- Honesty policy regarding cheating, plagiarism, misbehaviour: University rules and regulations.

E- Grading policy: University rules and regulations

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

25 References:

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

1. Inorganic Chemistry, by Catherine E. Housecroft and Alan G. Sharpe, 5th edition, Pearson, 2018.

B- Recommended books, materials, and media:

1. Inorganic Chemistry, by Miessler, Fischer, and Tarr, 5th Edition, Pearson, 2014.
2. Inorganic Chemistry, by Shriver, Weller, Overton, Rourke, Armstrong, 6th Edition, Oxford University Press, 2014.

26 Additional information:

Name of Course Coordinator: Dr. Hazem Amarne Signature: ---------- ------ Date: 25/08/2023
Head of Curriculum Committee/Department: ---------- Signature: ---------- ----------
Head of Department: ---------- Signature: ---------- ----------
Head of Curriculum Committee/Faculty: ---------- Signature: ---------- ----------
Dean: ---------- Signature: ---------- -----