



Lahore University of Management Sciences

CHEM 521 – Advanced Inorganic Chemistry I Fall 2023

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Course URL (if any)	

Course Basics				
Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	1 hr 15 minutes
Recitation/Lab (per week)	Nbr of Lec(s) Per Week	NA	Duration	NA
Tutorial (per week)	Nbr of Lec(s) Per Week	NA	Duration	NA

Course Distribution	
Core	Chemistry Core
Elective	NA
Open for Student Category	Chemistry Graduate Students, Chemistry Seniors
Close for Student Category	NA

COURSE DESCRIPTION
The course consists of three parts. The first part will start with the study of structure, bonding, and periodic trends. In the second part, we will discuss the principles of molecular symmetry as a tool to discuss molecular structure. We will also use the concepts of symmetry and molecular orbital theory to explore properties of large complex molecules. The third part will cover the chemistry of the coordination compounds with special focus on electronic spectra of transition metal complexes. If possible, brief introduction of organo-transition metal chemistry and catalysis will be studied.

COURSE PREREQUISITE(S)
<ul style="list-style-type: none">NA

COURSE OBJECTIVES
<ul style="list-style-type: none">To study orbital shapes, electronic configurations.To correlate orbital energies with periodicity (Ionization energy, electron affinity etc.).To identify symmetry elements present in a given molecule/structure, and assign correct point group to the given molecule/structure.Apply the principles of symmetry & group theory to solve simple problems in chemical bonding, molecular vibrations, and electronic spectra of transition metal complexes.To cover the chemistry of the coordination compounds with emphasis on isomerism, bonding, electronic spectra, & reaction mechanism.To cover the chemistry of organo-transition metal compounds with emphasis on reaction mechanism & industrial catalysis. Acquaintance with the current literature in inorganic chemistry.



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Learning Outcomes

After successful completion of this course, students should be able to

- Explain periodic trends
- Recognize various symmetry elements (axis, plane, rotation-reflection, inversion) present in a given molecule or structure.
- Assign correct point group based on the symmetry elements present in a given molecule/structure,
- Understand and predict spectroscopic as well as magnetic properties of coordination compounds based upon number of unpaired electrons, type of ligands.
- Understand organometallic reactions/mechanisms.
- Read the current inorganic literature.

Grading Breakup and Policy

Assignment(s): 0%; Assignments will be given and will also be checked, however these will not contribute towards the final grade.

Home Work:

Quiz(s): 20% (5-7 quizzes) Note: All quizzes given will count towards this instrument of the grade.

Class Participation: All students are strongly encouraged to actively participate in class discussions.

Attendance: Students are required to attend and actively participate in all the classes. Less than 90% Attendance will result in F Grade.

Midterm Examination: 35%

Presentation: 10% All students will give one PowerPoint presentation of 15-20 minutes duration on any cutting edge topic related to inorganic/organometallic chemistry. For this you are strongly encouraged to read research papers (ACS, RSC, Willy, or Nature group) from now onwards.

Final Examination: 35% (this will be *Comprehensive Final Exam* covering all the concepts studied throughout this semester)

I can change the grading breakup up to $\pm 5\%$. In case of online teaching and exam, the midterm and final exams will have viva components.

Examination Detail

Midterm Exam	Yes/No: Yes (Two midterm exams, will be arranged by instructor himself) Combine Separate: Duration: 3hr Preferred Date: Exam Specifications: Closed Books, Closed Notes, Calculators allowed
Final Exam	Yes/No: Yes Combine Separate: Duration: 3 hr Exam Specifications: Closed Books, Closed Notes, Calculators allowed

COURSE OVERVIEW

Week/ Lecture/ Module	Topics	Recommended Readings	Objectives/ Application
Module 1 Weeks 1-3	Revision of basic concepts, shapes of orbitals, electronic configurations and the periodic table, orbital energies and the effective nuclear charges, Periodic trends, ionization energy, electron affinity, Trends in Oxidation states.	Chapter 8 & 9 Keeler & Wothers	To learn electronic configuration and periodic trends.
Module 2 Weeks 3-8	Chemical applications of Symmetry & Group Theory	Alan Vincent	Applications of Symmetry and group theory in chemistry



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Module 3 Weeks 9-14	Coordination Chemistry, Structures, Bonding, Electronic Spectra, Reactions, & Applications	Chapter 7, 19, 20, 21 Shriver Atkins Chapter 9-12 Miessler & Tarr	To review the key features of coordination compounds
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Textbook(s)/Supplementary Readings

Text Books

- Chemical Structure and Reactivity an Integrated Approach by James Keeler & Peter Wothers, 2nd Edition, 2014, Oxford.
- Molecular Symmetry & Group Theory by Alan Vincent, 2nd Edition, 2001, John Wiley and Sons.
- Shriver & Atkins Inorganic Chemistry by Mark Weller, Jonathan Rourke, Tina Overton, & Fraser Armstrong, 7th Edition, 2018, Oxford.

Supplementary Readings

- Inorganic Chemistry by Gary L. Miessler & Donald A. Tarr, 5th Edition, 2014, Pearson.
- Inorganic Chemistry by Catherine E. Housecroft & Alan G. Sharpe, 5th Edition, 2018, Pearson.

Academic Honesty

The principles of truth and honesty are recognized as fundamental to a community of teachers and students. This means that all academic work will be done by the student to whom it is assigned without unauthorized aid of any kind. Plagiarism, cheating and other forms of academic dishonesty are prohibited. Any instances of academic dishonesty in this course (intentional or unintentional) will be dealt with swiftly and severely. Potential penalties include receiving a failing grade on the assignment in question or in the course overall. For further information, students should make themselves familiar with the relevant section of the LUMS student handbook.

Harassment Policy

SSE, LUMS and particularly this class, is a harassment free zone. There is absolutely zero tolerance for any behavior that is intended, or has the expected result of making anyone uncomfortable and negatively impacts the class environment, or any individual's ability to work to the best of their potential.

In case a differently-abled student requires accommodations for fully participating in the course, students are advised to contact the instructor so that they can be facilitated accordingly.

If you think that you may be a victim of harassment, or if you have observed any harassment occurring in the purview of this class, please reach out and speak to me. If you are a victim, I strongly encourage you to reach out to the Office of Accessibility and Inclusion at oai@lums.edu.pk or the sexual harassment inquiry committee at harassment@lums.edu.pk for any queries, clarifications, or advice. You may choose to file an informal or a formal complaint to put an end of offending behavior. You can find more details regarding the LUMS sexual harassment policy [here](#).

To file a complaint, please write to harassment@lums.edu.pk.

SSE Council on Equity and Belonging

In addition to LUMS resources, SSE's **Council on Belonging and Equity** is committed to devising ways to provide a safe, inclusive and respectful learning environment for students, faculty and staff. To seek counsel related to any issues, please feel free to approach either a member of the council or email at cbe.sse@lums.edu.pk

Rights and Code of Conduct for Online Teaching

A misuse of online modes of communication is unacceptable. TAs and Faculty will seek consent before the recording of live online lectures or tutorials. Please ensure if you do not wish to be recorded during a session to inform the faculty member. Please also ensure that you prioritize formal means of communication (email, lms) over informal means to communicate with course staff.