University of Management & Technology
School of Science
Department of Chemistry

CH-604 ADVANCED INORGANIC CHEMISTRY (A)			
Lecture Schedule	Mon/Tue 1830-2130	**Semester**	Spring 2024
Pre-requisite	Graduate Standing	**Credit Hours**	3
Instructor(s)	Dr. Sohail Nadeem	**Contact**	sohail.nadeem@umt.edu.pk Extension. 3436
		Moodle Link	
Office	2nd Floor, South Block, S3-32.	**Office Hours**	Mon, 15:00-18:00 Tue, 15:00-18:00
Teaching Philosophy	For the past ten years, I have had the privilege of teaching inorganic chemistry to numerous graduate students. My teaching career is more of a teaching calling, a passion and love to connect the material and beauty of the science to the students. Since I've been teaching, my mantra is "It's all about the students!" I do my best to encourage and challenge my students, to make my courses relevant to their interests/world, and to have students actively participate in their learning. In addition, I want my students to be well-trained in critical thinking, problem-solving ability, questioning, and extending knowledge. I desire that my students will have the best learning experiences as a student. In turn, they will be better-prepared and develop more quickly as deep thinkers and will connect their learning experience with their life experience. For these reasons, I am constantly rethinking and reworking my teaching methods by paying close attention to best practices for the best interest of my students. My teaching philosophy has evolved over the years and would not be what it is today without the creative freedom that the Chemistry Department at UMT has entrusted me. I am grateful for all of the constructive criticism and praise that students have offered and for the support from my colleagues. Fellow faculty and students have been my great teachers as I am still a student, still a learner. I absolutely love my job. I can't imagine doing anything else with my professional life.		
Course Description	This course describes the advanced concepts in bonding of molecules, the physical/chemical techniques such as diffraction methods, UV/Vis, IR *etc*. Topics related to the molecular term symbols and its applications to the spectroscopic studies have been included. Tenabe-Sugano diagrams and their utilization. Brief introduction		

	of utilization of enzymes in inorganic chemistry and biochemistry of nonmetals have been discussed. Concepts of interfaces, symmetry of the molecules has been added.
Expected Outcomes	Participants who successfully complete this course will learn and understand the advanced concepts of inorganic chemistry which includes; Explain electronic configurations of large atomic numbers elements. Molecular vibrations and electronic spectra spin orbit coupling. Electronic States and Term Symbols electronic states for octahedral complexes, tanabe-sugano diagrams and spectra of d-block complexes. Identify the chemical and physical properties of transition metal complexes. Demonstrate an understanding of sensors and their mode of action.
Course Objectives:	To identify creation of the elements in the periodic table and their universal abundance. Understanding of physical techniques involved for the analysis of inorganic compounds. To understand the general procedure for the correct electronic configuration of high atomic number elements and their bonding order in various molecules. To understand the photochemical processes and their applications Term symbols of the coordination compounds with emphasis on bonding and electronic spectra. Molecular sensors and their role in biological systems. Acquaintance with the current literature in inorganic chemistry
Textbook(s)	1. Shriver and Atkins' Inorganic Chemistry, Fifth Edition, W. H. Freeman and Company, 41 Madison Avenue, New York, NY 10010. 2023. Side Readings: 2. J H Huheey, Inorganic Chemisry - Principles, structure and reactivity, Harper and Row Publisher, Inc. New York (2008). 3. James E House Inorganic Chemistry; Academic Press is an imprint of Elsevier 30 Corporate Drive, Suite 400, Burlington, MA 01803, USA (2008). 4. Wai-Kee Li Advanced Structural Inorganic Chemistry, Oxford University Press, 3 Great Clarendon Street, Oxford OX2 6DP. UK. 2008
Attendance	**80% attendance is mandatory**
Grading Policy	Quizzes: 10% Presentation: 05% Assignments: 05% Case Study: 05% Midterms: 25% Final: 50%

Course Schedule

Week	Lecture #	TOPICS	CH	SECTIONS Page #
1*	1	Introduction to advanced inorganic chemistry, Bonding in Inorganic Compounds, Formation of the Elements (the Big Bang), The Detectable Elements, Subatomic Particles Involved in the Formation of the Elements, What's Out There? Is There Enough Matter for the Formation of New Galaxies?, Keyhole Nebula in Carina, Contrasts with organic Chemistry,	1	(Shriver, 01-16)
2*	2	Simple bonding Theory, VBT, MOT, VSEPR, LFT,	8	(Meisler Tarr, 45-77)
3*	3	Bonding in metal complexes, multiple bonds *etc*.	8	(Shriver, 230-240)
4*	4	MOT Bonding concepts of diatomic molecules, Finding the bond order.	8	(Shriver, 241-250 179-196)
5*	5	Molecular symmetry, An introduction to symmetry analysis, Symmetry operations, elements and point groups, Character tables, Applications of symmetry, Polar molecules, Chiral molecules, Molecular vibrations,	6	(Shriver, 179-189)
6*	6	The symmetries of molecular orbitals, Symmetry-adapted linear combinations, The construction of molecular orbitals, The vibrational analogy, Projection operators.	6	(Shriver 190-200)
7*	7	Electronic States and Term Symbols, electronic states for diatomic molecules and their consequences, electronic states for octahedral complexes,	11	(Miessler Tarr 379-407)
8*	8	electronic states for octahedral complexes,	11	(Miessler Tarr 379-407)
9*	9	**(MID TERM EXAM)**		
9*	9	Interpretation of Spectra of d-metal ions, splitting of spectroscopic states, orgel diagrams, racah parameters and quantitative methods, the nephelauxetic effect, tanabe-sugano diagrams, charge transfer absorption.	18	(House 645-668)
10*	10	Electronic Absorption Spectra: Spectra of Octahedral and Tetrahedral complexes (d1 and d9) systems, Energy level diagrams d2-d8, spectrochemical series, remarks on intensities and line widths of charge transfer spectra	15	(Shriver 535-546)
11*	11	Ionic radii, John-Teller effects, Thermodynamic effect of d-orbital splitting; Formation constants of complexes octahedral vs Tetrahedral coordination.	08	(Shriver 515-546)

12*	12	Metal carbenes, metal carbynes, Synthesis, Chemical Reactions, bridging carbenes and carbynes, metathesis, oligomerizaiton and polymerization reactions of Alkenes.	05	(Shriver 250-251)
13*	13	Biological inorganic chemistry, The organization of cells, The physical structure of cells, Transport, transfer, and transcription, Sodium and potassium transport, Calcium-signalling proteins, Zinc in transcription, Selective transport and storage of iron. Iron-transport proteins in higher organisms. Release of iron from transferrin, Ferritin, the cellular Fe store.	26	(Shriver 763-779)
14*	14	Oxygen transport and storage, Myoglobin, Haemoglobin, Other oxygen-transport systems, Reversible O 2 binding by small-molecule analogues. General considerations.	26	(Shriver 780-788)
15*	15	Iron–sulfur clusters, Copper electron-transfer centres Sensors,	26	(Shriver 788-815)
16*	16	Iron proteins as sensors	26	(Shriver 788-815)
17	17	The principle of O2 sensing by prolyl oxygenases. Proteins that sense Cu and Zn levels. Biominerals, Common examples of biominerals.	26	(Shriver 788-815)
18*		Final Exam		

* - Tentative

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