

Name of Faculty	:	Faculty of Science
Name of Program	:	Master of Science
Course Code	:	1MSO01
Course Title	:	Inorganic Chemistry
Type of Course	:	Basic Science
Year of Introduction	:	2023-24

Prerequisite	:	Basic knowledge about periodic table, nature of bonds in inorganic chemistry
Course Objective	:	Inorganic chemistry has a greater potential in the fields of metallurgy, synthesis of new materials from different elements, bioinorganic, etc. It focuses on solving the fundamental problems associated with structure of atoms, molecules and their properties. It not only expand critical thinking and the ability to understand other scientific and engineering concepts more easily, but also open new horizons to pursue career in different fields.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Understand the nature of bond and its properties through various electronic structural methods bonding models
	CO2	Corelate magnetic properties of complexes with strength of ligand field
	CO3	Understand and analyze structure-property correlation of coordination compounds
	CO4	Remember and assign symmetry characteristics to molecules and objects
	CO5	Appreciate specialized and advanced topics in inorganic and coordination chemistry
	CO6	Design new coordination compounds based on a fundamental understanding of their electronic properties

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
4	0	0	4	70	30	-	-	100

Legends: **L**-Lecture; **T**-Tutorial/Teacher Guided Theory Practice; **P** – Practical, **C** – Credit, **SEE** – Semester End Examination, **CIA** - Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping With COs
1	<p>VSEPR theory: Postulate of VSEPR theory, the "AXE method" of electron counting in VSEPR, Recap of shapes of regular geometries. Predicting types of hybridization of central atom in a molecules/ions (Shape or Geometry and bond angles) (with and without lone pair of electrons) like SbF_4^-, SF_5^-, SeF_3^-, ICl_2^-, ICl_4^-, IF_4^-, IOF_4^-, NH_2^-, NH_4^+, I_3^-, PCl_2^+, PCl_6^-, SO_4^{2-}, ClF_3, IF_6^-, BrF_5, $XeOF_4$, XeF_4, XeO_3, SOF_2, IF_5, $[BF_4]^-$, $[I_5]^+$, $[Br_3]^+$, BCl_3, SNF_3, XeF_2O_2, ClO_3^-, $[TeF_5]^-$, $[BeF_4]^-$, $[SbCl_6]^{3-}$, $[PF_6]^-$ etc. Advantages and disadvantages (Drawbacks) of VSEPR theory, Energetic of hybridization, Bent's rule, d-orbital participation by non-metals, example showing $p\pi-p\pi$, $p\pi-d\pi$ and $d\pi-d\pi$ bonds. Some simple reaction of covalently bonded molecule: atomic inversion and Berry pseudo rotation).</p> <p>Molecular Orbital Theory: Molecular orbital representation of polyatomic molecules with special reference to CH_4, NH_3, H_2O, PF_5, SF_6, B_2H_6 and CO and delocalised molecular orbital of ozone, carbon dioxide, nitrite, nitrate and benzene.</p>	15	25%	CO1
2	<p>Bonding in metal Complexes: Crystal Field Theory: Salient features of CFT. d-orbital splitting patterns in regular Octahedral, tetragonally distorted octahedral, Jahn-Teller theorem, trigonal bipyramidal, trigonal planar, Pentagonal bipyramidal, and linear geometries. Concept of weak field and strong fields. - Calculation of crystal field stabilization energies (CFSE's) in six and four coordinate complexes. Types of magnetic behavior- magnetic susceptibility - calculation of magnetic moment from magnetic susceptibility spin only formula,- Quenching of orbital angular momentum - Determination of magnetic moment from Guoy's method. Applications of magnetic moment data for the determination of oxidation states, bond type and stereochemistry. Spin crossover: High spin, low spin cross over phenomenon in $[Fe(Ophen)_2(NCS)_2]$ and $[Fe(R_2NCS)_2]_3$ Spinels.</p>	15	25%	CO1 CO2 CO3 CO5 CO6

3	Symmetry and Group Theory: Representation of groups –some properties of matrices & vectors, representation of groups, the Great orthogonality theorem and its consequences, character table, wave functions as basis for irreducible representations, direct product, identifying nonzero matrix elements.	15	25%	CO4
4	Bio-inorganic Chemistry: Metalloporphyrins (enzymes) definition, hemoglobin and myoglobin, cytochrome, vitamin B12 (cyano cobalamin), zinc metallo enzymes, nitrogen fixation, essential and trace elements in biological system, biochemistry of non metals K, Na pump (action of bath ions), toxic metals and their toxicity. Co-ordination compounds in medicine Chelation therapy, gold compounds and rheumatoid arthritis, anticancer drugs –platinum complexes, gold complexes, metallocenes etc, antimicrobial agents, metal complexes as radiodiagnostic agents, magnetic resonance imaging.	15	25%	CO5

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	16.67	33.32	16.67	16.67	-	16.67

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested Learning Websites

Sr.No.	Name of Website
1	https://nptel.ac.in/courses/104101121
2	https://nptel.ac.in/courses/104101090
3	https://onlinecourses.nptel.ac.in/noc22_cy40/preview
4	https://nptel.ac.in/courses/104105033

Reference Books

Sr. No.	Name of Reference Books
1	Concise Coordination Chemistry : R Gopalan and V Ramalingam (Vikas publishing House Pvt. Ltd)
2	Selected Topics In Inorganic Chemistry: W.U. Malik, G.D. Tuli & R.D. Madan (S. Chand Publications)
3	Symmetry and Spectroscopy of Molecules: K Veera Reddy New Age International publishers,

	2014. Group Theory and its Chemical Applications - P.K. Bhattacharya (Himalaya Publishing House) 2003
4	Group theory and symmetry in chemistry, L. H. Hall (McGraw Hill)
5	Advanced Inorganic Chemistry. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, 6th Edition, Wiley Interscience, N.Y (1999)
6	Inorganic Chemistry, 5th Edition: Gary L. Miessler, Paul J. Fischer and Donald A. Tarr Pearson Publication.
7	Inorganic Chemistry, J.E. Huheey, K. A. Keiter and R. L. Keiter 4 th Edition Harper Cottens College Publications (1993).
8	Homogeneous Catalysis by Metal complexes Vol I, M M Taqui Khan and A E Martell, Academic Press NY (1974).
9	Inorganic Chemistry, Keith F. Purcell and John C. Kotz, Holt-Saunders International Editions, London (1977).
10	Advanced Inorganic Chemistry 3rd, 5th & 6th Editions: F.A. Cotton& G. Wilkinson:
11	Theoretical Approach in inorganic chemistry: A.F. Willims
12	Inorganic Chemistry, K. F. Purcell and J. C. Kotz.
13	Inorganic Biochemistry vols I and II ed. G. L. Eichhorn, Elsevier
14	Bioinorganic Chemistry, I. Bertini, H. B. Gray and S. J. Lippard
15	Principals of Bioorganic Chemistry, S. J. Lippard and J. M. Berg.
16	Inorganic Reaction Mechanisms, M. L. Tobe, Nelson Pub
17	Bioinorganic Chemistry, I. Bertini, H. B. Gray, S. J. Lippard and J. S. Valentine.