Syllabus for Master of Science

Inorganic Chemistry-I

Subject Code: 02CY0402

Subject Name: Inorganic Chemistry-I

M.Sc. Sem - I

Objectives:

- To understand the key features of coordination compounds, including the variety of structures, oxidation numbers, electronic configurations and stability of complexes.
- To be able to use magneto chemistry to understand the magnetic properties and the colour of coordination compounds.
- Explain and predict the chemical behavior and reactivity of coordination compounds.
- Increase awareness of the contributions of various organic and inorganic reagents.

Credits Earned: 5 Credits

Course Outcomes: After completion of this course, student will be able to-

- Explain the fundamental concepts in coordination chemistry of transition metals.
- Explain the bonding characteristics in coordination compounds in term of Crystal Field Theory.
- Relate the physical properties and reactivities of selected transition metal complexes with their structure and bonding.
- Formulate mechanisms for reactions of transition metal complexes.
- Realize the importance of inorganic compounds in bioinorganic chemistry.

Pre-requisite of course: NA.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	CSE/Internal (I)	Viva (V)	Term work (TW)	
4	0	3	6	50	30	20	25	25	150

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Contents:

Unit	Topics	Contact Hours
1	**Coordination Compounds:** Double salts, Coordination compounds, Coordination complexes and complex ions, Coordination number, various types of ligands, Color of coordination compounds, chelates, Effective atomic number, Valance bond theory, Crystal field theory, Crystal field splitting of energy levels, Crystal field stabilization energy, Magnetic properties of metal complexes, Ligand field theory, Jahn-Teller effect.	20
2	**Magneto chemistry:** Definition, Ferromagnetism, Anti-ferromagnetism, Ferri-magnetisms, Diamagnetism and Pascal's Constant, Russell-Saunders (RS) or LS Coupling, Relations between Multiple width to kT, Stereo chemical applications of Magnetic Properties of the First Transition Series, Lanthanides and actinides, Determination of magnetic susceptibility by Gouy's Method.	15
3	**Electron spin resonance:** Theory of ESR, ESR applications for the structure determination of metal complexes, Applications of ESR for understanding metal complexes relevant to biology. Interaction between nuclear spin and electron spin.	10
4	**Applications of Inorganic reagents in Inorganic analysis:** The uses of some inorganic reagents: Potassium Bromate ($KBr0_3$), Potassium Iodate ($KI0_3$), Ammonium Vanadate (NH_4VO_3), Ceric Suphate [$Ce(S0_4)_2$], Ethylenediamine Tetra Acetic Acid (EDTA). **Uses of Organic reagents in inorganic analysis:** Cupferron, DMG, dithiozone, aluminon, oxine, dithiooxamide, a-benzoinoxime, a-nitro-(3-naphthol, a-nitrosoj3naphthol, diphenylcarbazone, diphenylcarbazide, anthranilic acid, tannin, pyragallol, benzidine. salicylaldoxime, o-phenanthroline.	15
	Total Hours	**60**

References:

1. J. E. Huheey, E. A. Keiter, R. L. Keiter, Inorganic Chemistry, 4th edn., HarperCollins, 1993.
2. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rd edn., Oxford University Press.
3. E. J. D. Lee, Concise Inorganic Chemistry, 5th edn., Blackwell Science, London.
4. Advanced Inorganic Chemistry- F. A. Cotton & G. Wilkinson, John Wiley.
5. Elements of Bioinorganic Chemistry- G. N. Mukherjee & A. Das.
6. Organometallic Chemistry- R. C. Mehrotra & A. Singh.
7. B. R. Puri, L. R. Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi.
8. B. Douglas, D. Mc Daniel, J. Alexander, Concepts and models in Inorganic Chemistry.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
30%	25%	15%	15%	10%	5%

Suggested List of Experiments:

1. To determine the amount of Ni^{+2} in the given $NiSO_4.7H_2O$ solution using 0.01 M EDTA solution.
2. Synthesis of Tetrammine cupric sulphate $[Cu(NH_3)_4]\ SO_4 \cdot H_2O$ and estimation of Copper.
3. Synthesis of Tri (thiourea) cuprous sulphate $[Cu(NH_2CSNH_2)_3]_2\ SO_4.2H_2O$ and estimation of Copper.
4. Synthesis of Tri (thiourea) cuprous chloride $[Cu(NH_2CSNH_2)_3]$ Cl and estimation of Copper.
5. Synthesis of Hexa ammine nickel(II) chloride $[Ni(NH_3)_6]\ Cl_2$ and estimation of Nickel.
6. Synthesis of Hexathioureaplumbus nitrate $[Pb(NH_2CSNH_2)_6]\ (NO_3)_2$ and estimation of Lead.
7. Synthesis of Pentathioureadicuprous nitrate $[Cu(NH_2CSNH_2)_5]\ (NO_3)_2$ and estimation of Copper.
8. Synthesis of Potassiumtrioxalato chromate $K_3[Cr(C_2O_4)_3]$ and estimation of chromium.

❖ **Reference Books:**

1. Vogel's textbook of quantitative chemical analysis, fifth edition, Longman Scientific & Technical.
2. D. A. Skoog, D. M. West, and S. R. Crouch, Fundamentals of Analytical Chemistry 8th edn, Brooks/Cole Nelson.
3. G. D. Christian, Analytical Chemistry, John Wiley and Sons.

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

e. Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.

f. All students in the laboratory must wear safety goggles and lab coats during lab session.

Supplementary Resources:

1. http://www.nptel.ac.in/courses/104103069/#
2. http://ocw.mit.edu/courses/chemistry/
3. http://vlab.amrita.edu/index.php?sub=2
4. http://www.vlab.co.in/ba_labs_all.php?id=9