Syllabus for Master of Science

Inorganic Chemistry-II

Subject Code: 02CY0452

Subject Name: Inorganic Chemistry-II

M.Sc. Sem - II

Objectives:

- To understand the key features of quantum chemistry, including the variety of theory and its applications in inorganic chemistry.
- To be able to understand Mossbuer Spectrosopcy, its application and implementation on inorganic compounds.
- Increase awareness of the contributions of bioinorganic chemistry.
- Explain and predict the chemical behavior and reactivity of ion exchangers and their role in seperation.

Credits Earned: 6 Credits

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

- Explain the fundamental concepts in quantum chemistry.
- Explain the application of Mossbuer spectroscopy.
- Analyse and implement bioinorganic chemistry in day to day life.
- Realize the importance of ion exchangers in separation techniques.

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	Viva (V)	Term work (TW)	
4	0	3	5	50	30	20	25	25	150

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Contents:

Unit	Topics	Contact Hours
1	**Introductions to Quantum Chemistry and its applications:** Applications of Quantum Mechanics to simple systems, LCAO-Mo and Valence Bond treatments ofH_2 molecule, electron Density, forces and their roles in chemical bonding. Born Oppenheimer approximation, Hybridization and valence MO's of Water, Ammonia and Methane molecule. Huckel π-electron theory and its applications to Ethylene, Butadiene and Benzene. Concept of Self-consistent field method.	20
2	**Mossbauer spectroscopy:** Introduction and Schematic Diagram of Mossbauer Spectrophotometer, Principle and Instrumentation of Mossbauer spectra, Applications, Quadrupole splitting. Recoil energy, Doppler effect. Experimental techniques. Chemical Shift.	15
3	**Fundaments of Bioinorganic Chemistry:** Introduction, Complexes of Ia and IIa group cations in Biological chemistry. Ferredoxin, iron-sulphur proteins and their relevance. Di-nitrogen complexes: their structure, binding and relevance in biology, Biological Nitrogen fixation. Di-oxygen complexes: their structure, binding relevance in biology	15
4	**Ion-Exchangers:** Introduction, classification of ionexchangers and their applications in the separation of following: 1. Zinc and Magnesium, 2. Chloride and bromide, 3. Cobalt and Nickel, 4. Cadmium and Zinc.	10
	Total Hours	**60**

References:

1. Introduction to Quantum Chemistry, A K Chandra, McGraw-Hill.
2. Vogel's Text book of Quantitative Inorganic Analysis, ELBS Press.
3. Quantum Chemistry, Ira N. Levine, Prentice-Hall International.
4. J. E. Huheey, E. A. Keiter, R. L. Keiter, Inorganic Chemistry, 4th edn., Harper Collins, 1993.
5. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rd edn., Oxford University Press.
6. E. J. D. Lee, Concise Inorganic Chemistry, 5th edn., Blackwell Science, London.
7. Advanced Inorganic Chemistry- F. A. Cotton & G. Wilkinson, John Wiley.
8. Elements of Bioinorganic Chemistry- G. N. Mukherjee & A. Das.

9. B. R. Puri, L. R. Sharma, Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi.

10. 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. Qualitative analysis: Analysis of mixture containing six radicals.
2. Qualitative analysis: Analysis of mixture containing six radicals including one rare metal ions-Li.
3. Qualitative analysis: Analysis of mixture containing six radicals including one rare metal ions-Mo.
4. Qualitative analysis: Analysis of mixture containing six radicals including one rare metal ions-W.
5. Analysis of ternary / quaternary mixtures: (at least one)
   (i) K^+: H^+: SO_4^{2-} ratio in $KHSO_4$
   (ii) H^+, Na^+, Mg^{2+} and Zn^{2+} in mixture
   (iii) Al^{3+}, Fe^{3+}, Co^{2+} and Ni^{2+} in mixture.

❖ **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, JohnWiley 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://store.elsevier.com/Comprehensive-Inorganic-Chemistry-II/isbn-9780080977744/
2. http://chemistry.about.com/cs/generalchemistry/a/aa072103a.htm
3. https://www.youtube.com/watch?v=LkPNsgAVeeQ
4. https://www.youtube.com/watch?v=HC81oYe43DI&list=PLm8ZSArAXicL3jKr_0nHHs5TwfhdkMFhh
5. https://www.youtube.com/watch?v=jOf_zHw2Hd4
6. https://www.youtube.com/watch?v=EE_T20QYSvw
7. http://www.nptel.ac.in/courses/104103069/#
8. http://ocw.mit.edu/courses/chemistry/
9. http://vlab.amrita.edu/index.php?sub=2
10. http://www.vlab.co.in/ba_labs_all.php?id=9