



COURSE HANDOUT (PART-II)

Date: 07-Jan-2016

In addition to part I (General handout for all courses appended to the timetable) this portion gives further details regarding the course.

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| Course No. | : CHEM F343 |
| Course Title | : Inorganic Chemistry III |
| Instructor-in-charge | : Bibhas Ranjan Sarkar |
| Co-Instructor | : Saumi Ray |

Course Description:

This course encompasses several aspects of the elements of periodic table encountered in inorganic chemistry typically in numerous application/ functional areas such as, life processes, modern day-to-day living, medical and fine chemical applications etc. Some important key-phrases are as follows,

Bio-inorganic chemistry; metalloenzymes; metalloproteins; role of alkali and alkaline earth metal ions, iron, copper and molybdenum etc. in life processes; metals in medicine; metal deficiency and toxicity aspects (mercury, cadmium, lead, beryllium, selenium and arsenic etc.); metals used in diagnosis and chemotherapy; electronic, magnetic and photonic materials; emerging research topics in inorganic chemistry, such as catalysis, inorganic polymers, nanomaterials and hybrid materials.

Learning Objective of the Course:

The most important objective of the course is to acquire understanding about the roles and importance of the different elements (majorly metals) in life processes, medicinal purposes and augmenting the quality of life of mankind by breakthrough advancements in human civilization. As an integral part of learning the applications of inorganic chemistry, this course will be utilizing the knowledge and understanding gained in the foundation courses of IC-1 and IC-2 for probing deeper in to the chemistry of biological systems, chemistry of modern materials, chemistry in industrial processes for commodity and fine chemicals, medicines, sensors etc. On successful completion of the course, the following learning objectives will be fulfilled

- Introduction to bioinorganic chemistry
- Understanding the role of metal centers in biological systems (typically redox systems)
- Metals in medical applications, toxicity and deficiency aspects
- Introduction to electronic, photonic and magnetic materials involving inorganic chemistry
- Inorganic chemistry involved in industrial applications such as polymer synthesis, catalysis etc.
- Exposure to the emerging research areas of functional materials chemistry including inorganic polymers, nanomaterials, hybrid materials etc.





Text Books

T1. J. A. Cowan, "Inorganic Biochemistry An Introduction", Wiley-VCH, 2nd edition.

T2. The Science and Engineering of Materials, Donald R. Askeland, Pradeep P. Phule, Cengage Learning (India edition)

Reference Books

R1. S. J. Lippard and J. M. Berg, "Principles of Bioinorganic Chemistry", University Science Books

R2. I. Bertini, H. B. Gray, S. J. Lippard, J. S. Valentine, Bioinorganic Chemistry", Viva, 1998.

R3. William D. Callister, Materials Science and Engineering, Wiley-India Edition, 2007.

Course Plan:

| Lec. No. | Topics to be covered | Learning Objectives | Reference: |
|----------|--|--|-----------------------------|
| 1 | Bioinorganic Chemistry | Introduction | Classnotes, T1, Ch-1 |
| 2-4 | Metal ion Storage and Transport | Metal ion uptake and transmembrane ion transport, storage of metal ions | T1; p133-61 |
| 5-7 | Metalloproteins and Metalloenzymes | Oxygen carriers and Hydrolase enzymes | T1; p167-194 |
| 8-10 | Redox reactions involving transition elements | Redox Chemistry of transition metal ions in biology | T1; p203-221 and Class note |
| 11-13 | Electron transfer pathways | Involvement of Redox Chemistry in electron transfer pathways | T1; p221-247 and Class note |
| 14-16 | Role of alkali and alkaline earth metal ions | Membrane translocation, ion pumps, complexes with nucleic acids etc. | T1; p257-284 |
| 17-19 | Choice, uptake and assembly of metal containing units in biological system | Enrichment strategies and intracellular chemistry of low-abundant metals, Spontaneous self-assembly of metal clusters | Classnotes |
| 20 | Metal Deficiency and Disease | Introduction and overview, Essential metals, Anemia and Iron, Causes and consequences of zinc deficiency, copper deficiency | Classnotes |
| 21 | Toxic effects of Metals | Copper overload and Wilkinson diseases, Iron Toxicity, Toxic effects of other essential elements, Mercury Toxicity and Bacterial resistance, cadmium and lead toxicity | Classnotes |
| 22 | Metals used in diagnosis and | Radiodiagnostic agents, Magnetic Resonance Imaging, Lithium and mental health, Gold and | Classnotes |





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| | chemotherapy | Rheumatoid Arthritis | |
| 23-25 | Electronic Materials | Band structure of solids, Conductivity in solids, Superconductivity, Semiconductors, Insulators and dielectric properties, Piezoelectricity, Pyroelectricity, Ferroelectricity | T2; p677-718 |
| 26-28 | Magnetic Materials | Classification of magnetic materials, Magnetization, Permeability, Diamagnetic, Paramagnetic, Ferromagnetic, Superparamagnetic materials, Domain structure and the hysteresis loop, The curie temperature, Metallic and ceramic magnetic materials | T2; p725-751 |
| 29-31 | Photonic Materials | The electromagnetic spectrum, Refraction, Reflection, Absorption and Transmission, Selective absorption, Transmission or Reflection, Example and use of emission phenomena | T2; p757-781 |
| 32-35 | Polymer synthesis, catalysis by metals | Types of polymerization reactions using metals, Catalysis types, variants | Classnotes |
| 36-40 | Emerging areas in inorganic chemistry | Inorganic polymers, Nanomaterials, Hybrid materials etc | Classnotes |

Evaluation Scheme:

| Serial No. | Evaluation Component. | Duration | Weightage | Date, Time & Venue. | Nature of Component. |
|------------|---------------------------|----------|-----------|---------------------|-------------------------|
| 1 | MIDSEM Test | 1.5h | 30% | 19/3 2:00 - 3:30 PM | Close Book |
| 2 | Tutorial Tests | ----- | 30% | Tutorial hour | Continuous, closed book |
| 3 | Comprehensive Examination | 3h | 40% | 16/5 FN | Close/Open Book |

Chamber Consultation Hour: To be announced in the class

Notices: Notices concerning the course will be put up on the chemistry notice board and/ or Nalanda.

Make-up Policy: Make-up for the MidSem & Comprehensive will be granted only for genuine cases

Bibhas R. Sarkar
Instructor-in-charge

