## Programme: M. Sc. Part-II (Inorganic Chemistry) Course Code: ICC-504 Title of the Course: Selected topics in inorganic chemistry - I Number of Credits: 03

Effective from AY: 2019-20

| Prerequisites<br>for the course: | The students with MSc-I Chemistry are eligible for this course.   | No. of<br>lectures |
|----------------------------------|---|--------------------|
| Course Objectives:               | <ol> <li>To gain knowledge in selected topics in inorganic<br/>chemistry.</li> <li>To learn s-block elements, selected compounds of d-block<br/>and f-block elements.</li> <li>To understand the basic electrochemical processes in<br/>inorganic compounds.</li> <li>To study the applications of inorganic compounds in<br/>selected areas.</li> </ol>  |                    |
| Course Outcomes:                 | <ol> <li>Students will be able to gain knowledge regarding<br/>chemistry (abundance, preparation, properties) of s, d and<br/>f block elements.</li> <li>Students will be able to gain knowledge of fundamentals<br/>of inorganic electrochemistry and medicinal chemistry.</li> </ol>  |                    |
| Content:                         | <ul> <li>1. S-block elements and their compounds</li> <li>1.1 Hydrogen and hydrides: Electronic structure, position in periodic table, abundance, preparation, properties, isotopes, ortho and para hydrogen. Classification of hydrides, preparation &amp; properties of hydrides; hydrogen ion, hydrogen bonding and its influence on properties.</li> <li>1.3 Group 1 Elements:</li> <li>Introduction, abundance, extraction, physical and chemical properties, solubility and hydration, solutions of metal in liquid ammonia, complexes, crowns and cryptands, electrides, alkalides, difference between lithium and the other group 1 elements, diagonal relationship between Li and Mg.</li> <li>1.4 Group 2 Elements</li> </ul> | 10 hr              |
|                                  | <ul> <li>Introduction, abundance, extraction, physical and chemical properties, solutions of metal in liquid ammonia, complexes, anomalous behaviour of beryllium, difference between beryllium and the other group 2 elements, diagonal relationship between Be and AI, preparation and properties Grignard reagent.</li> <li>2. Chemistry of d-block and f-block compounds</li> <li>2.1 Polyoxometallates; 1.2 metal sulphides and sulfido compounds; 1.3 Nitrido &amp; alkylidyne compounds; 1.4 Metal-</li> </ul>   | 6 hr               |
|                                  | metal bonded compounds and clusters; 1.5 coordination & organometallic compounds of lanthanides; 1.6 Electronic spectra of lanthanides & actinide compounds; 1.6 Brief chemistry of thorium, uranium, neptunium, plutonium &  |                    |

|                           | americium.   | 4 hr         |
|---------------------------|--|--------------|
|                           | <ul> <li>3. Fundamentals of Inorganic Electrochemistry         Basic aspects of electrochemistry, electron transfer reactions         at electrode surface, potential and electrochemical cells,         voltammetric techniques, linear voltammetry, cyclic         voltammetry; reversible, irreversible and quasi-reversible         processes; applications of cyclic voltammetry with reference         to ferrocenes, transition metal complexes.     </li> <li>4. Inorganic medicinal chemistry         Anticancer agents: Platinum and Ruthenium complexes as         anticancer drugs, Cancer chemotherapy, phototherapy,         radiotherapy using borane compounds, Chelation therapy,         Gadolinium and technetium complexes as MRI contrast         agents, X-ray contrast agents, Anti-arthritis drugs, Anti-         bacterial agents (Ag, Hg, Zn and boron compounds),         Antiseptic and anti-biotic, Deodorants and anti-perspirants,         Antiseptic and anti-biotic,         Deodorants and anti-perspirants,         Antiseptic and anti-biotic,         Deodorants and anti-perspirants,         Antiseptic and anti-biotic,         Deodorants and anti-perspirants,         Antiseptic and anti-biotic,         Deodorants and anti-perspirants,         Antiseptic and anti-biotic,         Deodorants and anti-perspirants,         Antiseptic and anti-biotic,         Deodorants and anti-biotic,         Deodorants and anti-biotic,         Deodorants         Antiseptic and         Ant</li></ul> | 8 hr<br>8 hr |
|                           | Anti-viral agents (influenza, herpes, hepatitis and HIV<br>viruses), Li drugs.<br>5. Nuclear Chemistry<br>Radioactivity, Decay processes and decay energy, half-life of<br>radioactive elements, Nuclear fission and fusion processes,<br>Nuclear reactor components and functions, Q values for<br>nuclear reactions, Nuclear waste management, Radiation<br>detection principles, Chemical separation techniques of<br>radioactive elements, Radio-analytical techniques, Activation<br>analysis.  | 8 11         |
| Pedagogy                  | Mainly lectures / tutorials / assignments / self-study or a combination of some of these could also be used to some extent.  |              |
| Text / Reference<br>Books | <ol> <li>P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller &amp; F.A.<br/>Armstrong 2010, Shriver &amp; Atkins' Inorganic Chemistry,<br/>Oxford University Press, 2010, 5<sup>th</sup> Ed.</li> <li>J.E. Huheey, E.A. Keiter &amp; R.L. Keiter, Inorganic Chemistry:<br/>Principles of structure and reactivity, Pearson, 2014, 4<sup>th</sup> Ed.</li> <li>J. D. Lee, Concise Inorganic Chemistry, Blackwell Science<br/>Wiley, 2015, 5<sup>th</sup> Ed. (Reprint)</li> <li>F.A. Cotton, G. Wilkinson &amp; P.L. Gaus, Basic Inorganic<br/>Chemistry, John Wiley 1995, 3<sup>rd</sup> Ed.</li> <li>F.A. Cotton &amp; G. Wilkinson, Advanced Inorganic Chemistry,<br/>Wiley Eastern, New Delhi, 1984, 3<sup>rd</sup> Ed. (4<sup>th</sup> &amp; 5<sup>th</sup> Ed.<br/>preferred)</li> <li>N. N. Greenwood &amp; A. Earnshaw, Chemistry of the<br/>Elements, Pergamon Press, Exeter, Great Britain, 1984.</li> <li>D. T. Sawyer, A. Sobkowak, J. L. Roberts Jr.,<br/>Electrochemistry for chemists, John Wiley, Inc., New York,<br/>1995, 2<sup>nd</sup> Ed.</li> </ol>   |              |

| 8. A. G. Sykes, Advances in Inorganic Chemistry, Academic        |  |
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| Press Ltd., UK Ed. 1991.   |  |
| 9. H. J. Arnikar, Essentials of Nuclear Chemistry, New Age Intl. |  |
| Publishers, 2011, 4 <sup>th</sup> Revised Ed.                    |  |
| 10. G. Friedlander, J. W. Kennedy, E. S. Macias, J. M. Miller,   |  |
| Nuclear & Radiochemistry, John Willey & Sons, New York,          |  |
| 1981, 3 <sup>rd</sup> Ed.  |  |

Programme: M. Sc. Part-II Inorganic Chemistry Course Code: ICC-505

**Title of the Course:** Experiments in Inorganic Chemistry

estimation of chloride

estimation of cobalt

and estimation of chromium

|  | <b>ise.</b> Experiments in morganic chemistry                                 |          |  |  |
|--|---|----------|--|--|
| Number of Credits: 03 Effective from AY: 201 |   |          |  |  |
| Prerequisites                                | Students should have studied the courses ICC-401, ICC-402 and ICO-401         | No. of   |  |  |
| for the                                      | ta M. ScI level   | lectures |  |  |
| course:                                      |   |          |  |  |
| Course                                       | 1. To introduce to practical knowledge in Inorganic Chemistry.                |          |  |  |
| Objectives:                                  | 2. To learn techniques of crystallization of ligands and synthesis of         |          |  |  |
| Objectives.                                  | coordination compounds  |          |  |  |
|  | 3. To learn characterization of compounds using different instruments         |          |  |  |
|  | 4. To provide experience of synthesis and characterization of materials       |          |  |  |
|  | 5. To introduce analysis of ores for metal content                            |          |  |  |
| Course                                       | 1. Students will be in a position to understand general aspects involved      |          |  |  |
| Outcomes:                                    | in purification of ligands and synthesis of coordination of compounds         |          |  |  |
|  | 2. Students will be able to understand the methods for characterization       |          |  |  |
|  | of coordination compounds.  |          |  |  |
|  | 3. Students will be in a position to understand the solid state material      |          |  |  |
|  | synthesis and characterization.   |          |  |  |
|  | 4. Students will be able to separate metal ions by ion exchange               |          |  |  |
|  | chromatography. They will also gain knowledge about the analysis of           |          |  |  |
|  | ores and alloys   |          |  |  |
|  |   |          |  |  |
| Content:                                     | EXPERIMENTS IN INORGANIC CHEMISTRY  |          |  |  |
|  | Total sixteen experiments to be performed from the following.                 |          |  |  |
|  |   |          |  |  |
|  | <b>Group – 1</b> : Experiments in coordination chemistry: Ligand and complex  | 18       |  |  |
|  | synthesis, metal analysis <b>(Minimum 3)</b>                                  |          |  |  |
|  | 1) Purification (distillation / recrystallization) of ligands like acacH, en, |          |  |  |
|  | carboxylic acids etc)   |          |  |  |
|  | 2) Preparation of manganic tris(acetylacetonate) and estimation of            |          |  |  |
|  | managanese  |          |  |  |
|  | 3) Preparation of tris(thiourea) copper(I) sulfate and estimation of          |          |  |  |
|  | copper  |          |  |  |
|  | 4) Preparation of isomers; <i>cis</i> & trans dichloro-(ethylenediamine)-     |          |  |  |
|  | cobalt(III) chloride and estimation of cobalt                                 |          |  |  |
|  | 5) Preparation and resolution of tris(ethylenediamine)cobalt(III) ion and     |          |  |  |

6) Preparation of *cis* and *trans*- potassium dioxalatodiaquo-chromate(III)

7) Preparation of nitro and nitrito-penta aminecobalt(III)chlorides and

8) IR spectral characterization of free ligands and coordinated ligands