# ARSD College, University of Delhi

## Model Course Handout/Lesson Plan

| Course Name : B.Sc. (Hons) chemistry | | | | | | |
|---|---|---|---|---|---|---|
| **Semester** | **Course Code** | **Course Title** | **Lecture (L)** | **Tutorial (T)** | **Practical (P)** | **Credit (C)** |
| IV | 32171401 INORGANIC CHEMISTRY - III | Coordination Chemistry | **4** | | | **4** |
| Teacher/Instructor(s) | | Mr. Bachan Meena | | | | |
| Session | | 2020-2021 | | | | |

**Course Objective:** The course introduces the students to coordination compounds which find manifold applications in diverse areas like qualitative and quantitative analysis, metallurgy, as catalysts in industrial processes as medicines, paints and pigments as well as in life. The student is also familiarized with the d and f block elements and get an idea about horizontal similarity in a period in addition to vertical similarity in a group.

**Course Learning Outcomes: By the end of this course, students will be able to:**

• Understand the terms, ligand, denticity of ligands, chelate, coordination number and use standard rules to name coordination compounds. • Discuss the various types of isomerism possible in such compounds and understand the types of isomerism possible in a metal complex. • Use Valence Bond Theory to predict the structure and magnetic behaviour of metal complexes and understand the terms inner and outer orbital complexes • Explain the meaning of the terms Δo., Δt, pairing energy, CFSE, high spin and low spin and how CFSE affects thermodynamic properties like lattice enthalpy and hydration enthalpy • Explain magnetic properties and colour of complexes on basis of Crystal Field Theory • Understand the important properties of transition metals like variable oxidation states, colour, magneticand catalytic properties and use Latimer diagrams to predict and identify species which are reducing, oxidizing and tend to disproportionate and calculate skip step potentials • Understand reaction mechanisms of coordination compounds and differentiate between kinetic and thermodynamic stability.

**Lesson Plan:**

| Unit No. | Learning Objective | Lecture No. | Topics to be covered |
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| 1. | Coordination Chemistry: | 1-2 | Recapitulation of Werner's Coordination theory |
| | | 3-4 | IUPAC nomenclature of coordination compounds. |
| | | 5-6 | isomerism in coordination compounds. with coordination numbers 4 and 6. |

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| | | 7-8 | A brief idea about chelate effect and labile and inert complexes. |
| | | 9-10 | Valence bond theory |
| | | 11-12 | VBT application to complexes of coordination numbers 4 and 6. Examples of inner and outer orbital complexes.. |
| | | 11-12 | Crystal field theory, |
| | | 13-14 | measurement of Δo. Calculation of CFSE in weak and strong fields, concept of pairing energies |
| | | 15-16 | factors affecting the magnitude of Δo. Octahedral vs. tetrahedral coordination, |
| | | 17-18 | octahedral geometry Jahn-Teller theorem, |
| | | 19-20 | Jahn-Teller theorem and tetragonal distortions from square planar geometry |
| | | 21-22 | Qualitative aspect of Ligand field and MO Theory |
| | | 23-24 | for octahedral σ-donor |
| | | 25-26 | (, π- acceptor and π- donor complexes). |
| | | | |
| | Transition Elements | 27-28 | General group trends with special reference to electronic configuration, colour |
| | | 29-30 | variable valency, magnetic properties (no temperature dependence), |
| | | 31-32 | catalytic properties, and ability to form complexes. |
| | | 33-34 | Latimer diagrams of Mn, Fe and Cu in acidic and basic media |
| 2 | | 35-36 | A brief discussion of differences between the first, second and third transition series |
| | | 37-38 | Some important compounds of Cr, Mn, Fe and Co and their roles as laboratory reagents; |
| | | 39-40 | Potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite. |
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| 3 | Lanthanoids and Actinoids: | 41-42 | A brief discussion of electronic configuration, oxidation states, A brief discussion of electronic configuration, oxidation states, |
| | | 43-44 | colour, spectral and magnetic properties. |
| | | 45-46 | Lanthanoid contraction (causes and effects) separation of lanthanoids by ion exchange method. |
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| 4 | Inorganic Reaction | 47-48 | Introduction to inorganic reaction mechanisms |

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| | Mechanism: | 49-50 | Concept of reaction pathways |
| | | 51-52 | transition state, intermediate |
| | | 53-54 | activated complex. Substitution reactions in square planar complexes, |
| | | 55-56 | Trans- effect, theories of trans-effect. |
| | | 57-58 | Thermodynamic Stability (using VBT). |
| | | 59-60 | Kinetic stability (using VBT). |

**Evaluation Scheme:**

| No. | Component | Duration | Marks |
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| 1. | Internal Assessment | | 25 |
| | ● Quiz | | |
| | ● Class Test | | |
| | ● Attendance | | |
| | ● Assignment | | |
| 2. | End Semester Examination | 3 hr | 75 |

| Details of the Course | | |
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| **Unit** | **Contents** | **Contact Hours** |

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| | **Total** | **16** |

**Suggested Books:**

| Sl. No. | Name of Authors/Books/Publishers | Year of Publication/Reprint |
|---|---|---|
| -1 | Atkins, P.W.; Overton, T.L.; Rourke, J.P.; Weller, M.T.; Armstrong, F.A. (2010),Shriver and Atkins Inorganic Chemistry, 5th Edition, Oxford University Press. | 2010 |
| 2 | 2. Miessler, G.L.; Fischer P.J.; Tarr, D. A. (2014),Inorganic Chemistry, 5th Edition, Pearson. | 2014 |
| 3 | Huheey, J.E.; Keiter, E.A.; Keiter; R. L.; Medhi, O.K. (2009),Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education | 2009 |
| 4 | Pfennig, B. W. (2015),Principles of Inorganic Chemistry. John Wiley & Sons. | 2015 |
| 5 | Cotton, F.A.; Wilkinson, G.(1999), Advanced Inorganic Chemistry Wiley-VCH. | 1999 |

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| **Mode of Evaluation:** | Internal Assessment / End Semester Exam |