Approval: 8th Senate Meeting

Course Name: Chemistry of Transition Elements

Course Number: CY506

Credits: 3-1-0-4

Prerequisites: B.Sc. (with Chemistry) or Teachers consent

Intended for: UG/PG

Distribution: Core

Semester: Odd/Even

Course Preamble: This course builds up on the undergraduate inorganic courses and aims to provide the students with advanced/deeper understanding of the theories and concepts in transition metal chemistry, inorganic reaction mechanisms, electrochemistry and nuclear chemistry.

Course Outline:

- **Structure, bonding and properties of transition metal complexes: [12 Lecture]**

Theories of metal-ligand bonding and their limitations; CFT, d-orbital splitting; CFSE; low-spin and high-spin complexes and magnetic properties; LFT and Molecular Orbital (MO) theory of selected octahedral and tetrahedral complexes.

- **Spectral and magnetic properties of coordination compounds [8 Lectures]**

Term symbols and splitting of free ion terms in cubic and square planar fields - crystal field configurations and term diagrams - Orgel and Tanabe-Sugano diagrams - selection rules for electronic transitions – electronic spectra of simple ions and calculation of B and β - magnetic properties of metal complexes.

- **Reaction mechanisms: [8 Lectures]**

Substitution reactions in octahedral and square planar complexes, trans effect and its influence, water exchange, anation, acid and base hydrolysis, stereochemistry, inner and outer sphere electron-transfer mechanisms.

- **Principles of electrochemistry [7 Lectures]**

Oxidation and reduction, use of redox potential data. Analysis of redox cycles,redox stability in water, disproportionation, Frost, Latimer and Pourbaix diagrams.

- **Inner transition elements [10 Lectures]**

Spectral and magnetic properties, complex formation, important oxides and complex oxides, analytical applications.

- **Nuclear chemistry [11 Lectures]**

Nuclear reactions, fission and fusion, radio analytical techniques and activation analysis

Reference Books:

1. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann*, Advanced Inorganic Chemistry*, Wiley, 6th edition, 2007.
2. J. E. Huheey, E. A. Keiter and R. L. Keiter, *Inorganic Chemistry*: *Principles of Structure and Reactivity*, 4th edition, Pearson Education Inc., 2000. B. Douglas, D. McDaniel and J. Alexander, *Concepts and Models of Inorganic Chemistry*, 3rd edition, Wiley, 2006.
3. J. D. Lee, *Concise Inorganic Chemistry*, 5th edition, Wiley, 2010.
4. P. Atkins et al, *Shriver & Atkins' Inorganic Chemistry*, 5th edition, W. H. Freeman and Company, New York, 2010.
5. B.C. Harvey, *Introduction to Nuclear Chemistry*, Prentice-Hall (1969)
6. G. Friedlander, J.W. Kennedy, E.S. Marcus & J.M. Miller *Nuclear & Radiochemistry*. John-Wiley & Sons (1981)
7. H. J. Arnikar, *Essentials of Nuclear Chemistry*, 4th edition, New Age International Publishers (2010)