Course No	Course Name	L-T-P-Credits
CY 404	**Transition and Post Transition Metal Chemistry and Reaction Mechanism**	**3-0-0: 3**
Prerequisite: NIL		

Course Objectives: The main objective of the course is to provide basic concepts of the bonding theories of metal complexes, based on which electronic and magnetic properties of metal complexes can be ascertained. The course will also provide understanding on the inorganic reaction pathways, their kinetics and an overview on the characteristics of lanthanides and actinides.

Course Outcomes: After successful completion of the course, students will be able to:

1. Understand various theories of bonding in metal complexes.
2. Evaluate geometry and isomerism of metal complexes.
3. Understand Term symbol associated with metal ions.
4. Understand electronic and magnetic properties of metal complexes.
5. Analyse electronic spectra of metal complexes originating from d-d or charge transfer transitions.
6. Understand inorganic reaction mechanism involving metal complexes with different geometries.
7. Understand mechanisms of electron transfer reactions of metal complexes.
8. Understand basic concepts of lanthanides and actinides.

SYLLABUS

Module	Contents	Hours
I	**Theories of bonding in transition metal complexes** Crystal field theory (CFT), crystal field splitting in octahedral, tetrahedral and square planar complexes, crystal field stabilization energy and its applications, limitations of CFT. Molecular orbital (MO) theory for octahedral, tetrahedral and square planar complexes, π-bonding and MO theory, Jahn-Teller distortion from octahedral geometry. Isomerism in co-ordination compounds.	10
II	**Electronic and magnetic properties of transition metals complexes** Russell-Sanders coupling (L-S coupling) and micro states; ground state terms for d1 – d10 transition metal ions-Derivation of terms symbol; Hund's rules for lowest energy states; selection rules for electronic transitions, charge transfer transitions. Splitting of free ion terms in octahedral field, correlation diagram-Orgel diagrams and Tanabe-Sugano diagram. Magnetic properties: Magnetic susceptibility, Curie's law, spin–	10

	cross over, magnetic properties of complexes with A, E and T ground terms.	
III	**Reaction Mechanism and Kinetics** Substitution reactions in octahedral and square planar complexes; Rate law and mechanism of substitution reaction in square planar complexes, Trans effect. Mechanism and kinetics of octahedral substitution influence of acid and bases on reaction rate, racemisation and isomerisation reactions. Redox reactions: Mechanism of redox reaction (outer and inner sphere mechanism), excited state outer sphere electron transfer reactions; theoretical treatment of electron transfer process, applications to bio-inorganic chemistry.	8
IV	**Chemistry of Lanthanides and Actinides** Principal Characteristics of the rare Earth Elements, Oxidation state, periodic properties, lanthanide and actinide contraction, separation of lanthanides and actinides, magnetic and spectral properties of lanthanides, reactions, lanthanide shift reagents and its application; radioactivity.	8

Essential Readings:

1. J. E. Huheey, E. A. Keiter, R. L. Keiter and O. K. Medhi, Inorganic Chemistry: Principles of structure and reactivity, Pearson Education, 4th Edition, 2006.
2. F.A. Cotton, G. Wilkinson, C.A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, Wiley, 6th Edition, 2007.
3. B. R. Puri, L. R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry-, Vishal Publishing Co., 32nd Edition, 2014.

Supplementary Readings:

1. J. D. Lee, Concise Inorganic Chemistry, Oxford University Press, 5th Edition, 2008.
2. Wahid U. Malik, G. D. Tuli and R. D. Madan, Selected Topics in Inorganic Chemistry, S.Chand Publishing, Revised Edition, 2010.