

6. Chemical Kinetics, K. J. Laidler, Pearson Education, Anand Sons(India) 3<sup>rd</sup> ed., 2008.  
7. Fundamentals of Chemical Kinetics, M.R.wright, Harwood Publishing, Chichesrer, 1999.  
Kinetics & Mechanisms of Chemical Transformations, J Rajaram & J C Kuriacose,  
Macmillan, Delhi, 2007.

## CH S 554: ORGANOMETALLIC CHEMISTRY

### COURSE OUTCOME:

- The students will learn Historical development of Organometallic compounds, Classification,
- Nomenclature, Transition metal to carbon multiple bonded compounds, Transition metal-carbon pi complexes,
- Catalysis by organometallic compounds, Homogeneous catalysis by organometallics, Hydrocarbonylation of olefins,
- Ziegler-Natta catalyst and Water Gas Shift reactions in this course.

### UNIT- I:

[12 Hours]

Historical development- classification and nomenclature, bond energies and stability. 16- and 18-electron rules. Transition metal alkyls and aryls- types, routes of synthesis, stability and decomposition pathways,. Nucleophilic and electrophilic cleavage of metal-carbon sigma bonded compounds. Alkane activation.

Transition metal to carbon multiple-bonded compounds- carbenes, carbynes, synthesis, nature of bond, agostic interactions, structural characteristics and reactivity. Transition metal hydrides – synthetic routes, properties, structure and reactivity, synthetic applications.

### UNIT-II:

[12 hours]

Transition metal-carbon pi complexes: Preparative methods, nature of bonding, structural features of olefinic, acetylenic, allylic, butadiene, cyclobutadiene,  $\eta^5$ -cyclopentadienyl,  $\eta^6$ -benzene and other arenes, cycloheptatriene and cyclooctatetraene complexes. Important reactions relating to nucleophilic and electrophilic attack on ligands. Fluxional isomerism in olefin, allyl, dienyl and cyclopentadienyl complexes. Carbene complexes and metallacycles, arene complexes. Isolobal concept.

### UNIT- III:

[12 hours]

Catalysis by organometallic compounds: oxidative addition, insertion, deinsertion and reductive elimination reactions.

Homogeneous catalysis by organometallics- hydrogenation, hydrosilation, hydrocyanation and isomerization of olefins, immobilisation of homogeneous hydrogenation catalysts, Hydrocarbonylation of olefins (oxo reaction–cobalt and rhodium oxo catalysts), Wacker process. Carbonylation of alcohols- Monsanto acetic acid process. Polymerization of olefins and acetylenes: Ziegler-Natta catalyst systems. Fischer – Tropsch reaction , Water Gas Shift reactions.

### REFERENCES:

1. J.P.Collman, L.S.hegedus, J.R.Norton and R.G.Finke: Principles and Applications of
2. Organotransition Metal Chemistry, University Science Books, 1987.
3. R.C.Mehrotra and A.Singh: Organometallic Chemistry, New Age International, 1999.
4. R.H.Crabtree: Organometallic Chemistry of Transition Metals, Wiley , 1999.
5. F.A.Cotton and G.Wilkinson : Advanced Inorganic Chemistry, Wiley, 1991.
6. Organometallic Chemistry, G. S. Sodhi, Ane books Pvt Ltd Edition 2009.