Curriculum Plan of Dr. Kapil Mohan Saini
(Odd Semester 2025-2026)
Semester-V

Name of Paper & Code: CHEMISTRY –DSC: Basics of Organometallic Chemistry (DSC-13)-Inorganic Chemistry-V (3 Periods Per Week)

Contents	Allocations of Lectures	Month wise Schedule to be followed	Tutorials/ Assignment/ Presentation
Unit-1: Introduction to Organometallic Chemistry (Hours: 6) Definition**,** brief history, classification of organometallic compounds on the basis of bond type. Common notation used in organometallic chemistry, concept of hapticity of organic ligands, importance of organometallic chemistry, organometallic compounds as reagents, additives, and catalysts. Introduction to the 18-electron rule or effective atomic number rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series and finding metal-metal bonds.	6	1st Week of August – 3rd week of August	- Syllabus Overview - Reference Books - Problem Solving - Class Test,
Unit-2: Structure and Bonding in Organometallic Compounds (Hours: 12) Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. Molecular orbital theory applied to organometallic compounds, description of bonding of two electron ligands to transition metals. π-acceptor behavior of CO (MO diagram of CO to be discussed), π-bonding of CO with metal (synergic effect) and use of IR data to explain extent of back bonding, bonding modes of CO, symmetry of metal carbonyls. Bonding between metal atoms and organic π- systems: linear (ethylene, allyl, butadiene) and cyclic (cyclopentadiene, benzene), Zeise's salt and comparison of synergic effect with that in carbonyls. Metal alkyls and Metal-carbene complexes	12	4th Week of August – 3rd Week of September	- Problem Solving - Class Test,
Unit-3: Synthesis, Reactions and Applications of Organometallic Compounds (Hours: 16) General methods of synthesis of metal carbonyls: direct carbonylation, reductive carbonylation, thermal and photochemical decomposition, of mono and binuclear carbonyls of 3d series. Reaction of metal carbonyls: reduction, oxidation, photochemical substitution, migratory insertion of carbonyls, and nucleophilic addition of CO. Synthesis of metal-alkene complexes through ligand addition, reduction and substitution and reaction of metal bound alkenes, Zeise's salt Metal–sandwich compounds**:** Ferrocene: synthesis, physical properties and reactions: acylation, sulfonation, alkylation metallation, acetylation, chloromercuration, Mannich reaction, comparison of aromaticity and reactivity of ferrocene with that of benzene. Synthesis and reactions of Metal alkyls and Metal-carbenes	16	3rd Week of September - 3rd Week of October	- Problem Solving - Class Test,
Unit-4: Catalysis by Organometallic Compounds (Hours: 11) General principles of catalysis, properties of catalysts, homogeneous and heterogeneous catalysis. (Catalytic steps, examples and industrial applications), deactivation and regeneration of catalysts, (catalytic poisons and promoter). Organometallic catalysis of the following reactions of commercial importance and their mechanism:	11	3rd Week of October-November	- Problem Solving

1.Alkene hydrogenation (using Wilkinson's Catalyst) 2.Synthetic gasoline preparation (Fischer Tropsch reaction) 3.Polymerisation of ethene using Ziegler-Natta catalyst 4.Wacker oxidation process (Smidth process) 5.Hydroformylation reaction (Oxo-process) 6.Monsanto Acetic Acid process			