Industrial Homogeneous Catalysis: Principles and Mechanism

Course Title	**Industrial Homogeneous Catalysis: Principles and Mechanism**
Course Category	~~Pedagogy / Specialized Skills~~/ Research/ ~~Generalized skills~~
Relevant Discipline(s)	**Chemistry/Chemical Engineering/Materials Science & Engineering**
Duration of course in equivalent integer no. of days (min 3 days, 1 day = 6 hrs of lectures/hands on sessions)	**3 days (the actual classes will be scheduled over 6 days: 3 hours class on each day)**
Proposed dates	**Class 1: 7th December , 2020 6-9 PM** **Class 2: 8th December , 2020 6-9 PM** **Class 3: 9th December , 2020 6-9 PM** **Class 4: 15th December, 2020 6-9 PM** **Class 5: 16th December, 2020 6-9 PM** **Class 6: 17th December, 2020 6-9 PM**

Brief Course Description and Course Contents

Module 1. Industrial catalysis

Here, we will cover the following topics as per the following schedule:

Class 1 (3 hours Lecture)

A. Industrial homogeneous catalysis, pharmaceutical synthesis, demands, problems and solutions: Suzuki Coupling Reaction; Hydrogenation Reaction; Monsanto Acetic Acid Process; Sonogashira Coupling Reaction
B. Issue of scalability, side product formation in reactions: Counting of Electrons; Ligand Substitution Reactions; Oxidative Addition; Reductive Elimination; Migratory Insertion & Elimination Reactions; Alpha-Migratory Insertion & alpha-Elimination Reactions; Beta-Migratory Insertion; Alpha-Abstraction & beta-Abstraction; 4-Center Reactions; [2+2] Reactions; External Attack by a Ligand & Reductive Coupling

Class 2 (3 hours Lecture)

C. Practical issues in Heck Coupling Reaction; Buchwald-Hartwig Coupling Reaction; flow chemistry solutions.
D. Pauson–Khand Reaction; Application in industry, challenges, and opportunity.

Class 3 (3 hours practical session)

E. Predicting the pattern of reactions in industry, retro analysis, visualizing the problem; preventing side product formation.
F. Developing the skill sets to address the issues faced in homogenous catalysis, industrial demands, scalability issues, chemistry perspective

Module 2. Connecting the Chirality and Symmetry and their practical applications

In the second section of the class, we will discuss as per the following schedule.

Class 4 (3 hours Lecture)

A. Dihydride Catalyst; Stereoselective Hydrogenation Reaction; Hydroformylation; Hydrocarboxylation; Hydrocyanation

B. Asymetric Hydrogenation; Transition Metal Carbenes Fischerand Schrock Carbenes; Olefin Metathesis; Alkyne Metathesis; Cyclopropanation Reaction; Catalytic Cyclopropanation Reaction and Introduction to Cross Coupling Reaction; Kumada Coupling Reaction; Stille Coupling Reaction; Asymetric Suzuki Coupling Reaction

Class 5 (3 hours Lecture)

C. Asymetric Heck Reaction Introduction to Buchwald-Hartwig Coupling Reaction; Role of Ligands its Influence in Buchwald-Hartwig Coupling Reaction; Oxidative Cyclisation Process; Application of Oxidative Cyclization in Natural Product Synthesis

D. Synthesis of Reactive Metallacycle Intermediate via-Beta-Abstraction and their Applications; Kulinkovich Reaction and its Mechanism.

Class 6 (3 hours practical session)

G. Knowledge of pharamaceuticals, their synthesis by homogeneous catalysis, retro analysis, side products, product isolation, characterization and sacalability and flow chemsitry solutions.

The class notes and other reading materials will be provided during the class.

Instructor Details			
S. No.	**Name of the Instructor**	**Department**	**Email**
1	Debabrata Maiti	Chemistry	dmaiti@chem.iitb.ac.in