Semester II

# COURSE CCCH4A: Organic Chemistry Group A (Theory, Credits:04)

## Chemistry of Aliphatic Hydrocarbons: Lecture 20

A. Carbon-Carbon sigma bonds:Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

B. Carbon-Carbon pi bonds: Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

*Reactions of alkenes:* Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

*Reactions of alkynes:* Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

## Alkanes, Cycloalkanes and Conformational Analysis: 16 Lectures

Nomenclature, types of strain, Bayer strain theory, measurement of strain and classification of ring sizes, consequences of strain in small, normal, medium and large ring, conformation behaviours of normal rings, substituted cyclohexanes, effect of substitution on ring conformation of cyclohexane, conformation of cyclohexene, effect of strain on reactivity, ring synthesis - principles controlling ring closure reactions, rules for ring closure (Baldwin's rule), ring expansion and contraction processes, polycyclic system - Bredt's rule, Conformational analysis of n-butane, dihaloethanes, glycols.

## Aromatic Hydrocarbons: 12 Lectures

*Aromaticity:* Hückel’s rule, aromatic character of arenes, cyclic carbocations/carbanions and

heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft’s alkylation/acylation with their mechanism. Directing effects of the groups.

## Chemistry of Halogenated Hydrocarbons: 12 Lecture

*Alkyl halides:* Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.

*Aryl halides:* Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

# COURSE: CCCH4B (Practical, Credits: -02) (60 Lectures)

1. Purification of organic compounds by crystallization using the following solvents:

* Water
* Alcohol
* Alcohol-Water

2. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)

3. Qualitative analysis of solid organic compounds in respect of the following: Detection of elements, determination of M.P., detection of functional group and preparation of a derivative (with M.P):

4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.

# Learning Objective

- To gain knowledge on the structure and properties of special class of organic compounds, viz., aliphatic hydrocarbons, aromatic hydrocarbons and alkyl halides.

- To gain knowledge on the reactivities and reaction mechanisms related to the hydrocarbons and halides.

* To identify the reaction intermediates in the free radical mechanism.
* Empirical rules for regioselectivity associated with elimination process.

- Practical knowledge on how to make qualitative analysis of a pure organic compound

-Practical knowledge on how to purify an organic compound.

# Learning Outcome

At the end of this course the students will have a strong background on identifying the properties and reactivities of aliphatic, aromatic hydrocarbons and halides from their structure. They also gain the practical knowledge on making qualitative analysis of organic compounds and their purification technique.

# Reference Books