Cross cutting issues — (Environment & Sustainability) 2018-19

B. Sc. Chemistry
First Year (Semester-I) CBCS
Paper-I Organic + Inorganic Chemistry (CCC-I, Section –A)

Credits: 02 **Periods: 45**

Part- I
Organic Chemistry

Unit-I

1. Nomenclature of Organic Compounds : 06

Functional groups and types of organic compounds, Basic rules of IUPAC nomenclature, Nomenclature ofmono- and bi-functionalcompounds on the basis of priority order of the following classes of compounds: alkanes,alkenes, alkynes, haloalkanes, alcohols, ethers, aldehydes, ketones,carboxyclic acids, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), nitro compounds, nitriles and amines; Nomenclature of aromatic compounds: mono-, di-, and polysubstitutedbenzene (with not more than two functional groups),Monosubstitutedfused polycyclic arenes – naphthalene, anthraceneand phenanthrene. Nomenclature of bicyclic compounds.

2. Basic Concepts In Organic Chemistry : 07

Substrate and Reagents.

Types of reagents(Electrophilic and Nucleophilic).
Homolytic and heterolytic fission.
Electron mobility:

a) Inductive effect (effect on acidic strength of the following acid: acetic acid, propanoic acid and α-chloro acetic acid)
b) Mesomerism (aniline, nitrobenzene)

c) Hyperconjugation (toluene)

d) Stearic effect(mesitoic acid)

Formation and Study of reaction intermediates with stability order (Carbocations, Carbanions, Freeradicals,CarbenesNitrenes, Arynes.)
Types of organic reaction: Substitution, Addition, Elimination, Rearrangement. (With one example)

Unit-II

3. Alkanes and Cycloalkanes : 04

3.1 Alkanes
Introduction, Preparation of alkane from a) Hydrolysis of Grignard reagent
b) Kolbes synthesis c) Corey House synthesis

Chemical Reactions:

a) Pyrrolysis (mechanism) b) Aromatization

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3.2 Cycloalkanes Introduction, Synthesis from a) Adipic Acid b) Aromatic hydrocarbon c) Dickman reaction. Baeyer-Strain Theory and Sache Mohr Theory. Ring opening reaction with H_2 and HI

4. Alkenes, Dienes and Alkynes : 08

4.1 Alkenes

Introduction,Preparation methods:

a) But-1-ene from 1-butyne, b) But-2-ene from n-butyl alcohol and sec-butyl alcohol. Chemical Reactions: (with mechanism)

a) Electrophilic addition of Br_2 to ethene

b) Free radical addition of HBr to propene. (Peroxide effect)

c) Reaction of propene with Cl_2/ H_2O (Chlorohydrin formation)

d) Oxymercuration-Demercuration reaction

(Conversion of 3, 3-dimethyl-1-butene to 3, 3-dimethyl-2-butanol)

e) Cis-hydroxylation using alkaline $KMnO_4$.

4.2 Dienes

Introduction and classification

Resonance structure and molecular orbital picture of 1, 3-butadiene

Preparation methods of 1, 3-butadiene from-
a)1, 4-dibromobutane
b)1,4-butanediol.
Chemical Reactions:
a) Addition of Br_2 and HBr to 1,3-butadiene

b) Addition of ethene to 1,3-butadiene (Diel's-Alder reaction)

4.3 Alkynes

Preparation of ethyne (Acetylene) from a) Iodoform
b) Hydrolysis of calcium carbide Chemical Reactions (With Mechanism): Electrophilic addition of ethynewith HBrand Br_2

Unit-III

5. Alcohols and Epoxides 05

5.1 Alcohols

Introduction and Classification.

i) Dihydric alcohols: (Ethylene Glycol)

Nomenclature,
Preparation methods:
a) Hydroxylation of alkene b) 1, 2-dihaloalkanes. Chemical reactions:
Reaction with hydrogen chloride (HCl)

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B. Sc. First Year (Semester-II)
Paper-III [CCC-II, Section-A]
Organic + Inorganic Chemistry

Credits: 02

Part –A
Organic Chemistry

Periods: 45

Unit-I

1. Aromatic Hydrocarbons and Aromaticity **10**

Source, Nomenclature, isomerism of aromatic compounds.Structure of benzene, stability, orbital picture of benzene.Aromaticityand anti-aromaticity byHuckel's Rule (Benzene, Naphthhalene,Anthracene, Pyrrole, Furan,Thiophene, Pyridine, Cyclobutadiene, Cyclopentadienylcation and anion).

Mechanism of electrophilic aromatic substitution of benzene: Nitration, halogenation, Birch reduction, Friedal Craft alkylation and acylation.

Orientation : Effect of Activatingand Deactivating Groups (-OH, $-NO_2$, $-CH_3$,Cl groups)On Aromatic Electrophilic (Nitration) substitution reaction (with mechanism)

Unit -II

2. Phenols **06**

Introduction,Classification,

Acidic character (Comparison of acidity : phenol and ethanol) Chemical Reactions :

Reimer-Tiemann reaction(Mechanism), Acetylation (mechanism), Fries rearrangement(Mechanism), Lederer-Manase reaction, Kolbe's Carboxylation reaction (Mechanism),Hauben-Hoesch reaction.

3. Haloalkene and Haloarene **08**

Haloalkene

A] Vinyl Chloride:

Synthesis of vinyl chloride from 1) 1, 2-Dichoroethane 2) Ethene 3) Ethyne

Chemical Reactions :

Resonance structure of vinyl chloride

Addition reaction with Br_2 and HBr, polymerization reaction.

B] Allyl Iodide:

Synthesis of allyl iodide from (a) allyl chloride (Finkalstein reaction) (b) glycerol and HI.

Chemical Reaactions :

Reaction with NaOH, KCN, NH_3, $AgNO_2$ and Br_2.

Haloarene

Nomenclature,Synthesis of halobenzene from 1) Hunsdiecker reaction 2) Gatterman reaction 3) Balz-Schiemann reaction.

Chemical Reaactions: (with mechanism)

Ullmannbiaryl synthesis, Dows process (Reaction with NaOH)

Relative reactivity of alkyl halide v/s vinyl and aryl halide towards nucleophilic substitution.

Unit -III

3. Carboxylic Acid Derivatives 06

A] Acid chlorides:(Acetyl chloride)

Introduction

Preparation Methods:

a) By the action of thionyl chloride on acetic acid.

b) By the action of phosphorus pentachloride on acetic acid.
Chemical Reactions:
a) Hydrolysis

b) Action with alcohol c)
Action with amines
d) Action with sodium acetate.

B] Acid anhydride : (acetic anhydride)

Introduction

Preparation Methods:

a) From acid halide and carboxylic acid..

b) From sodium acetate and acetyl chloride.

Chemical Reactions:

a) Hydrolysis

b) Action with alcohol c)
Action with amines
d) Action with benzene

C] Esters:(Ethyl acetate)

Preparation Methods:

a) From ethyl alcohol and acetic acid

b) From ethyl alcohol and acetyl chloride.

Chemical Reactions:
a) Alkaline hydrolysis.
b) Actionof amines
c) Reduction.

D] Amides: (Acetamide)

Preparation Methods:

a) By the action of ammonia on acid chloride.

b) By the action of ammonia on acetic anhydride.
Chemical Reactions:
a) Hydrolysis

b) Action of nitrous acid
c) Reduction
d) Action of Br_2 and NaOH.

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B.Sc. First Year
Paper-V |CCCP-I|

credits: 04 Periods : 120

Note : At least Sixteen experiments should be taken.

A) Inorganic Chemistry

Identification of Two acidic and Two basic radicals by Semi-micro qualitative analysis technique.(Including interfering radicals). **(Any Six)**

1) At least eight mixtures of salt must be practiced.

2) Spot- tests (of each radical) are compulsory.

B) Organic Chemistry

I) Preparations **(Any Four)** :

a) Phthalimide from phthalic anhydride and urea.
b)Acetanilide from aniline.
c) Iodoform from acetone.

d) Phenyl – azo – β –naphthol from aniline. e) m-Dinitobenzene from nitrobenzene.
f) Phthalic anhydride from phthalic acid.
(Recrystallization and Melting point of product is compulsory)
II)Determination of Physical constant of Organic liquids **(Any four)**

Aniline, Ethanol, Toluene, Benzene, ortho and meta toluidines, Chlorobenzene and Nitrobenzene.
III)Demonstration on purification by -
a)Recrystalisation of Phthalic acid/Benzoic acid from hot water. b) Distillation of Ethyl alcohol.
c) Sublimation of Napthalene.

C) Physical Chemistry (Any Six)

1. Determination of the Viscosity of liquid by Ostwald's viscometer.

2. Determination of the Viscosity of two pure liquids A & B. Hence find the composition of the mixture of two liquids. (Density data of liquids, viscosity of water to be given).
[Any two liquids from : Acetone, Carbon terachloride, Chloroform, Ethyl alcohol, Benzyl alcohol, Ethylene glycol and n-propyl alcohol].
3. To determine the surface tension of a given liquid by stalagmometer method.

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4. Determine the equivalent weight of magnesium by hydrogen displacement method using Eudiometer.

5. To study Kinetics of hydrolysis of ester in presence of mineral acid like HCl.

6. Preparation of As_2S_3 solution from As_2O_3 and compare the precipitation power of NaCl and $MgCl_2$.

7. To study distribution of benzoic acid between benzene and water.

8. To study critical solution temperature (CST) of phenol water system.

9. Determination of Heat of solution of KNO_3/NH_4Cl.

10. Determination of Heat of reaction of displacement of copper by zinc.

11. To study kinetics of cooling of hot water.

Reference Books :

1. Advanced practical Inorganic chemistry by Gurudeep Raj.

2. Experiments in Inorganic chemistry by Gurtu andKapoor.

3. Practical Organic chemistry by A.I. Vogel.

4. Experiments inGeneral chemistry by C.N.R. Rao and Agrawal East West Press.

5. Experiments in Physical chemistry by R.C. Das and Behere, Tata McGraw Hill.

6. Experimental Physical chemistry by F. Daniel and others (International Student Edition).

7. Systematic Experimental Physical chemistry by S.W. Rajbhoj and Dr. T.K. Chondhekar, Anjali Publication, Aurangabad.

8. Advanced practical physical chemistry by J.B. Jadhav (Goel Publishing house, Meerut).

9. Experiments in Chemistry by D.V. Jahagirdar.

10. A Textbook of quantitative Inorganic analysis by A.I. Vogel.

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2019-20, 2020-21, 2021-22 - 2022-23

B.Sc. Chemistry First Year (Semester-I)

Paper-I: Organic + Inorganic Chemistry, (CCC-I)

Credits: 02 **Periods: 45**

Section-A (Organic Chemistry)

Unit-1

1. **Nomenclature of Organic Compounds:** **07**

Functional groups and types of organic compounds, Basic rules of IUPAC Nomenclature, Nomenclature of mono and bi- functional compounds on the basis of priority order of following classes of organic compounds: alkanes, alkenes, alkynes, alcohols, ethers, aldehydes, ketones, carboxylic acid, carboxylic acid derivatives (acid halides, esters, anhydrides, amides), amines; Nomenclature of aromatic compounds: Mono, di and polysubstituted benzene (with not more than two functional groups),

Unit-1I

2. **Basic Concepts in Organic Chemistry:** **09**

Basic terms: Substrate and Reagents, types of reagents (Electrophilic and Nucleophilic).

Notation of arrows: curved arrow, Half headed arrow, double headed arrow, straight arrow. Bond fission: Homolytic and heterolytic fission.

Reaction intermediates: Carbocation, Carbanion, Free radical, (Introduction, structure & Stability), carbene, nitrene & benzyne (only introduction).

Electron mobility: Inductive effect (effect on acidic strength of alpha substituted acetic acid and α-chloroacetic acid), Mesomeric effect (Aniline and Nitrobenzene), Hyperconjugation (toluene).

Unit-III

3. **Alkanes Alkenes and alkynes:** **08**

3.1 Alkanes: Introduction, Preparation of alkanes from a) Hydrolysis of Grignard reagent b) Kolbes synthesis. Chemical reaction: a) Pyrrolysis (mechanism), b) aromatization.

3.2 Alkenes: Introduction, Preparation methods a) But-1-ene from but-1-yne b) But-2-ene from butan-2-ol.

Chemical reactions with mechanism: a) Electrophilic addition of Br_2 to ethene b) Electrophilic addition of HBr to propene C) Free radical addition of HBr to propene (Peroxide effect).

Cross cutting issues (Environment & Sustainability)

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3.3 Alkynes: Introduction, Preparation of ethyne from a) Iodoform, b)Hydrolysis of calcium carbide. Chemical reactions: Electrophilic addition of HBr and Br_2 to ethyne (with mechanism).

Unit-IV

4. Cycloalkanes, Cycloalkenes and Dienes : **06**

4.1 Cycloalkanes: Introduction, Preparation of cycloalkanes from a)Adipic acid b)Aromatic hydrocarbon.

Baeyer strain theory and Saches Mohr theory. Ring opening reaction with H_2 and HI.

4.2 Cycloalkenes: Introduction, preparation methods:

a) Dehydration of cyclohexanol ,

b) Dehydrohalogenation of halocyclohexane.

Chemical reactions: a) Epoxidation of cyclohexene, b) Allylic halogenations.

4.2 Dienes: Introduction, classification & Resonance structures.

Preparation methods of 1,3-butadiene from- a) 1,4-dibromobutane, b)1,4-butanediol.

Chemical reactions: a) addition of Br2 and HBr to 1,3-butadiene, b) addition of ethene to 1,3-butadiene (Diel's- Alder reaction).

(Section –B : Inorganic Chemistry)

Unit- V

1 Periodic Table and Periodic Properties: **10P**

A] Periodic Table:

Modern periodic law, Long form of the periodic table, Sketch, Cause of periodicity, Division of elements in to s, p, d, and f blocks. General characteristics of s, p, d and f block elements.

B] Periodic properties:

a) Atomic and Ionic size: Definition and explanation of atomic radius, ionic radius, Covalent radius, Vander waals radius. Variation of atomic size along a period and in a group.

b) Ionization Energy: Definition and Explanation, Successive ionization energy, Factors affecting ionization energy. Variation of ionization energy along a period and in a group. Applications of ionization energy to chemical behavior of an element.

B.Sc. Chemistry First Year (Semester-II)

Paper-III: Organic + Inorganic Chsemistry, (CCC-II)

Credits: 02 **Periods: 45**

Section-A (Organic Chemistry)

Unit-I : Aromatic Hydrocarbons and Aromaticity **09**

Introduction, Nomenclature, kekule and resonance structure of benzene, stability, Orbital picture of benzene. Aromaticity and antiaromaticity by Huckel's Rule (Benzene, Napthalene, Anthracene, Pyrrrole, Furan, Thiophene, Pyridine, Cyclopentadienyl cation and anion, Cyclopropenyl cation). Electrophilic Substitution reaction of benzene (with mechanism): Nitration, Halogenation, Friedel Craft alkylation and acylation. **Orientation effect:** Effect of activating and deactivating groups (-OH, NO_2, CH_3, Cl) on aromatic electrophilic (Nitration) substitution reaction (with mechanism)

Unit-II: 1. Phenols **05**

Introduction, classification and acidic character of phenol (compare with ethanol). Chemical reactions with mechanism: Reimer-Tiemann reaction, Acetylation, Fries rearrangement, Kolbe's carboxylation reaction.

2: Haloalkenes and Haloarenes **06**

2.1 Haloalkenes:

a] Vinyl Chloride: synthesis of vinyl chloride from 1) 1, 2- dichloroethane 2) ethene Chemical reactions: Addtion reaction with HBr , polymerization reaction.

b] Allyl Iodide: synthesis of allyl iodide from 1) allyl chloride 2) glycerol and HI. Chemical reactions: reaction with NaOH, KCN, & Br_2.

2.2 Haloarenes:

Introduction, Synthesis of halobenzene from 1) Hunsdiecker reaction 2) Gattermann reaction. Chemical reactions (with mechanism): Ullamann biaryl synthesis. Resonance & Relative reactivity of alkyl halides v/s vinyl and aryl halides towards nucleophilic substitution reactions.

Unit-III : Carboxylic acid derivatives: **05**

A) Acid Chlorides: Introduction, preparation methods: 1) From acetic acid and thionyl chloride, 2) From acetic acid and phosphorous pentachloride . Chemical reactions: (Hydrolysis, Action with alcohol, Action with amines).

B) Acid anhydrides: Introduction, preparation methods: 1) From acetyl chloride and carboxylic acid, 2) From acetyl chloride and sodium acetate. Chemical reactions: (Hydrolysis, Action with alcohol, Action with amines).

C) Esters: Introduction, preparation methods: 1) From ethyl alcohol and acetic acid , 2) From ethyl alcohol and acetyl chloride. Chemical reactions: (Hydrolysis, Action of amines, Reduction).

D) Amides: Introduction, preparation methods: 1) From ammonia and acetyl chloride 2) From ammonia and acetic anhydride. Chemical reaction: (Hydrolysis, Action of nitrous acid).

Unit- IV: Alcohols and epoxides 05

A) Alcohols: Introduction and Classification.

a) **Dihydric alcohol (ethylene glycol):** Preparation methods: (Hydroxylation of alkene and From 1,2-dihaloalkane). Chemical reactions: [Reaction of ethylene glycol with, 1) $Pb(OAC)_4$, 2) $P_2O_5/ZnCl_2$].

b) **Trihydric alcohol (Glycerol):** Preparation methods from: 1) Oils and fats 2) Propene. Chemical reactions: [Reactions of glycerol with, 1) Nitric acid, 2) Acetyl chloride].

B) Epoxides : Introduction and nomenclature. Preparation methods:

a) Oxidation of ethene in presence of Ag catalyst , b) Oxidation of ethene with per acetic acid. Chemical reactions: (Ring opening reactions of propylene oxide in acidic

b) and basic medium/reagent,

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B.Sc. First Year

Paper-V [CCCP-I]

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c) Iodoform from acetone.

d) Phenyl – azo – β –naphthol from aniline. e) m-Dinitobenzene from nitrobenzene.

f) Phthalic anhydride from phthalic acid.

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