

RAJARSHI SHAHU MAHAVIDYALAYA, (AUTONOMOUS)

LATUR – 413512

DEPARTMENT OF CHEMISTRY



Syllabus

B.Sc. (Second Year) Chemistry

(III & IV Semester)

With Effect From 2018-2019

B.Sc. Second Year (Semester – III)

Chemistry

Paper	Course Code	Course Title	Periods Per Week	Total Periods	Marks
V	U-CHE-351	Physical and Inorganic Chemistry	03	30+15=45	50
VI	U-CHE-352	Organic and Inorganic Chemistry	03	30+15=45	50
-	U-CHE-353	Laboratory Course - III	03	45	50
-	U-CHE-354	Laboratory Course – IV	03	45	50

B.Sc. Second Year (Semester – IV)

Chemistry

Paper	Course Code	Course Title	Periods Per Week	Total Periods	Marks
VII	U-CHE-451	Physical and Inorganic Chemistry	03	45	50
VIII	U-CHE-452	Organic and Inorganic Chemistry	03	45	50
-	U-CHE-453	Laboratory Course – V	03	45	50
-	U-CHE-454	Laboratory Course – VI	03	45	50

B.Sc. Second Year (Semester – III)

Paper – V

Paper Code: U-CHE-351

Physical and Inorganic Chemistry (Section A + B)

Marks: 50
Credit: 02

Periods: 45
Weeks: 06

Learning Objective:

1. Introduce the students to Chemical Kinetics concepts, rate of reactions and different orders of reactions
2. To learn about photochemistry, difference between thermal and photochemical reaction and the laws of photochemistry
3. Familiarize the students with concepts of Phase rules and distribution law.
4. To know the principle of volumetric analysis and types of titrations.
5. Learn about different properties of P block element.

Course outcome:

After successful completion of the course the students:

1. Know the concepts of Chemical kinetics, rate of reactions and different orders of reactions
2. Can understand about photochemistry, difference between thermal and photochemical reaction and the laws of photochemistry .
3. Became familiarize with concepts of Phase rules and distribution law.
4. Can know the principle of volumetric analysis and types of titrations.
5. Can understand about different properties of P block element. Bonding and shapes of diamond Graphite and C₆₀ (Fullerene).

Section A: Physical Chemistry

Unit - I Chemical Kinetics-I:

08 Periods

- a) Introduction: Rate of reaction, Definition and units of rate constant, Factors affecting rate of a reaction, order and molecularity of a reaction.

- b) Zero order reaction: Rate expression and characteristics
- c) First order reaction: Rate expression and characteristics
- d) Pseudo unimolecular or pseudo first order reaction
- e) Second order reaction : Rate expression and characteristics (with equal and unequal concentration of reactants)
- f) Third order reaction : Rate expression and characteristics
- g) Methods of determination of order of a reaction : i) Hit and trial method ii) Half life method iii) Isolation method
- h) Numerical on half life method and order of reaction.

Unit - II Photochemistry:

08 Periods

- a) Introduction: Thermal and Photochemical reaction, Difference between them, electromagnetic spectrum.
- b) Lambert-Beer law – Discussion of, Optical density (O.D.) transmittance (Numerical Expected)
- c) Laws of Photochemistry: Grothus – Drapper law and Stark- Einstein law.
- d) Quantum yield (Brief view) and numerical.
- e) Photocatalysis.
- f) Jablonski diagram with various processes occurring in the excited state, Qualitative description of fluorescence, Phosphorescence, ISC and IC .
- g) Chemiluminescence and Photosensitized reactions
- h) Applications of Photochemistry; Application of fluorescence, Phosphorescence, LASER, MASER.

Unit - III Phase equilibria and Distribution Law :

14 Periods

A) Phase Equilibria :

- a) Phase rule; statement and explanation of the terms: phase, component and degree of freedom.
- b) One component system : H₂O, Sulphur and CO₂ system
- c) Two component system : Pb-Ag system, de-silverisation of lead (Parke's process), KI-H₂O system.
- d) Partially miscible liquids : critical solution temperature upper critical solution temperature, lower critical temperature phenol-water, triethylamine-water, Nicotin – water systems. Effect of impurities on critical solution temperature.

B) Distribution Law :

- a) Nernst distribution law : statement, explanation and limitations
- b) Henry's law and applications
- c) Applications of distribution law – solvent extraction, partition chromatography.

Section B: Inorganic Chemistry

Unit - IV Principles involved in volumetric Analysis : 08 Periods

Terms involved in volumetric analysis- Titrant , titrand, indicator, end point, equivalence point, titration error,

- a) Primary and secondary standards, preparation of standard solutions
- b) Types of titrations
- c) Theory of acid-base indicators
- d) Theory of Redox indicators
- e) Theory of Adsorption indicators
- f) Theory of Metal-ion indicators
- g) Theory of acid-base, redox, precipitation and complex formation titrations

Unit - V: Chemistry of p-block elements : (Group 13 to 17) 07 Periods

- a) Position of the elements in the periodic table
- b) Electronic configuration of elements
- c) Reasoning of anomalous behaviour of first member of each group
- d) Trends in the properties of elements with respect of following points :
 - i) Size of atoms and ions
 - ii) Ionisation potential
 - iii) Electronegativity
 - iv) Oxidation state
- v) Reactivity

Bonding and Shapes of the following molecules – P_4O_{10} , Diamond and graphite, C_{60} (Fullerene)

Physical Chemistry

- 1) Principles of Physical Chemistry By Maron and Prutton
- 2) Physical Chemistry by G.M. Barrow
- 3) Essentials of Physical Chemistry by Bhal and Tuli
- 4) Physical Chemistry by Robert A. Alberty
- 5) Principles of Physical Chemistry by Puri, Sharma, Pathania
- 6) Advanced Physical Chemistry by Harish Gurdeep
- 7) Text book of Physical Chemistry by Soni, Dharmarha
- 8) Advanced physical chemistry by D.N. Bajpai

Inorganic Chemistry

- 1) Principles of Inorganic Chemistry by Puri – Sharma – Kaliya
- 2) Inorganic Chemistry by Gurudeep Raj and Chatwal Anand
- 3) Advanced Inorganic Chemistry Vol. - I and Vol. - II by Satyaprakash, Tuli, Basu and Madan
- 4) Inorganic Chemistry By T. Moeller
- 5) Inorganic Chemistry by A.G. Sharp
- 6) Inorganic Chemistry by G.L. Miessler and D.A. Tarr
- 7) Text book of Inorganic Chemistry by – P.L. Soni

B. Sc. Second Year Chemistry(Semester III)

Paper – VI

Paper Code : U-CHE-352

Organic and Inorganic Chemistry (Section A+B)

Marks: 50

Periods: 45

Credit: 02

Weeks: 06

Learning objective:

- 1.To understand different Name reactions with mechanism.
- 2.To learn about properties,preparations of Carboxylic acids and their derivatives.
- 3.To know about Organic Compounds of Nitrogen & Organic Synthesis Via enolates.
4. Learn the concept of hybridization ,their types, rules, and applications .
- 5.Familiarize students with basic concept of coordination chemistry.

Course Outcome:

After successful completion of the course the students will :

1. Understand different Aldol condensation, Cannizzaro's reaction ,Mannich reaction etc. with their mechanisms.
- 2 .Learn about properties,preparations of Formic acid , Acetic acid & Chloro acetic acid,esters, acid amides
- 3.Can know about aromatic nitrogen compounds , diazonium salts & Organic Synthesis Via enolates.
4. Learn the concept of hybridization ,their types, rules, and applications .
- 5.Familiarize with basic concept of Coordination number ,Ligand ,Complex ion ,Coordinate bond etc.

Section A : Organic Chemistry

Unit - I

1.1 Name Reactions with Mechanism:

08 Periods

- 1.1.1 Mannich reaction
- 1.1.2 Knoevengel condensation reaction
- 1.1.3 Benzoin Condensation Reaction
- 1.1.4 Perkin's reaction
- 1.1.5 Gatterman Koch reaction

1.2 Reduction reactions

- 1.2.1 Clemmensen Reduction Reaction
- 1.2.2 Meervin-Pondorof Verly reduction reaction
- 1.2.3 Reduction with LiAlH_4
- 1.2.4 Reduction with NaBH_4

1.3 OXIDATION REACTIONS

- 1.3.1 Baeyer-Villiger Oxidation Reaction
- 1.3.2 Oppenauer oxidation

Unit - II

Carboxylic acids and their derivatives:

08 Periods

2.1 Carboxylic Acids

- 2.1.1 Introduction & classification
- 2.1.2 Methods of formation:
 - i) By oxidation of primary alcohol & secondary alcohol
 - ii) By hydrolysis of nitriles
- 2.1.3 Physical properties:

2.2 Carboxylic Acid Derivatives

A] Acid chlorides: (Acetyl chloride)

2.2.1 Introduction

2.2.2 Preparation Methods:

- a) By the action of thionyl chloride on acetic acid
- b) By the action of phosphorus pentachloride on acetic acid

2.2.3 Chemical Reactions:

- a) Hydrolysis
- b) Action with alcohol
- c) Action with amines

B] Esters: (Ethyl acetate)

2.2.4 Preparation Methods:

- a) From ethyl alcohol and acetic acid
- b) From ethyl alcohol and acetyl chloride.

2.2.5 Chemical Reactions:

- a) Alkaline hydrolysis.
- b) Action of amines
- c) Reduction.

C] Amides: (Acetamide)

2.2.6 Preparation Methods:

- a) By the action of ammonia on acid chloride.
- b) By the action of ammonia on acetic anhydride.

2.2.7 Chemical Reactions:

- a) Hydrolysis
- b) Action of nitrous acid
- c) Reduction
- d) Action of Br₂ and NaOH

Unit III

Organic Compounds of Nitrogen

08 Periods

3.1 Aromatic Nitro Compounds.

3.1.1 Introduction

3.1.2 Preparation of Nitrobenzene from benzene

3.1.3 Physical properties of Nitrobenzene.

3.1.4 Chemical properties:

3.1.5 Electrophilic substitution reactions

3.1.6 Reductions:

- a) in acidic medium
- b) in neutral medium

c) in alkaline medium

d) Electrolytic reduction

3.2 Aromatic amines:

3.2.1 Introduction & Classification

3.2.2 Methods of formation of aniline from:

a) chlorobenzene

b) phenol

c) nitrobenzene

d) phthalimide

3.2.3 Chemical properties:

a) Diazotization reaction

b) Action of carbon disulphide

c) Action of benzoyl chloride

d) Formation of Schiff's base

e) Carbylamine reaction

f) Formation of p-nitroacetanilide

3.2.4 Effect of substituent (-NO₂, -OCH₃, -CH₃) on the basicity of aniline.

3.3 Diazomethane

3.3.1 Introduction.

3.3.2 Methods of formation:

a) From N-nitroso-N-methylurethane

b) From nitrous oxide and methyl lithium

3.3.3 Reactions of Diazomethane

a) Action of heat

b) Reaction with mineral acid

c) Reaction with phenol

d) Reaction with ethanol and ethanamine

e) Ring expansion (cyclopentanone to cyclohexanone)

3.4 Urea:

3.4.1 Synthesis of urea by

a) Wohlers methods

b) From CO₂.

3.4.2 Chemical Reactions:

a) Action of heat

b) Hydrolysis

c) Action of thionyl chloride

d) Action of hydrazine

e) Salt formation

Unit IV

A] Introduction to Organometallic Compounds

06 Periods

4.1 Organomagnesium Compounds:

4.1.1 Preparation of Methyl magnesium bromide

4.1.2 Synthetic applications of Methyl magnesium bromide (CH_3MgBr)

4.2 Organo Lithium Compounds:

4.2.1 Preparation of methyl lithium from methyl iodide.

4.2.2 Synthetic application of Methyl lithium (CH_3Li)

4.3 Organo Zinc Compounds:

4.3.1 Preparation of diethyl zinc from ethyl iodide.

4.3.2 Synthetic application of diethyl zinc [$(\text{C}_2\text{H}_5)_2\text{Zn}$]

Section B : Inorganic Chemistry

Unit - IV Concept of Hybridisation :

08 Periods

- a) Definition of hybridisation of atomic orbitals
- b) Steps in the process of hybridization of atomic orbitals
- c) Rules of hybridisation of atomic orbitals
- d) Types of hybridization characteristics of each type of hybridization
- e) Advantages of concept of hybridization
- h) Explanation of shapes of following ions and molecules on the basis of hybridization :
 - i) BF_3
 - ii) SiCl_4
 - iii) PCl_5
 - iv) SF_6
 - v) SnCl_2
 - vi) CO_2
 - vii) NO_2^-
 - viii) CO_3^{2-}

Unit –V Coordination Chemistry-I

07 Periods

- a) Meaning of the terms -
 - i) Coordination number
 - ii) Ligand
 - iii) Complex ion
 - iv) Coordinate bond
- v) Coordination sphere
- vi) Chelation-definition, types of chelating agents, application of chelation with reference to DMG & EDTA.
- b) Difference between double salt and complex compound
- c) Types of ligands with examples
- d) Nomenclature of coordination compounds (mention latest IUPAC Rules)
- e) Isomerism in coordination compounds –Structural, Geometrical(C.N. 4 & 6) & Optical.

f) Application of complex compounds in everyday

References:

Organic Chemistry

- 1) Organic Chemistry – S.M.Mukherji, S.P.Singh, R.P.Kapoor (Vol. I & II)
- 2) Organic Chemistry by – Jagdambasingh, L.D.S.Yadav (Vol. I & II)
- 3) A text book of Organic Chemistry by – P.L.Soni
- 4) A text book of Organic Chemistry by – K.S.Tewari, S.N.Mehrotra, N.K.Vishnoi
- 5) A text book of Organic Chemistry by – Arun Bahl & B.S.Bahl
- 6) Principles of Organic Chemistry by – M.K.Jain
- 7) Advanced Organic Chemistry by – Jerry March
- 8) Organic Reactions and their Mechanisms by – P.S.Kalsi
- 9) Fundamentals of Organic Chemistry Solomon and T.W.Graham.
- 10) A text book of Organic Chemistry by G.K.Ahluwalia, Madhuri Goyal

Inorganic Chemistry

- 8) Principles of Inorganic Chemistry by Puri – Sharma – Kaliya
- 9) Inorganic Chemistry by Gurudeep Raj and Chatwal Anand
- 10) Advanced Inorganic Chemistry Vol. - I and Vol. - II by Satyaprakash, Tuli, Basu and Madan
- 11) Concise Inorganic Chemistry by J.D. Lee
- 12) Inorganic Chemistry by G.L. Miessler and D.A. Tarr
- 13) Inorganic Chemistry by Day and Selbin

B. Sc. Second Year Chemistry (Semester III)
Laboratory Course – III
Paper Code: U-CHE-353

Marks: 50
Credit: 01

Periods: 45
Weeks: 06

Learning Objective:

- 1.To familiarize the students with instruments,determination of stenth of different acids.
- 2.To know about how to determine energy of activation.
- 3.Learn about analysis of water sample.
- 4.To learn about preparation of standered solutions.

Course Outcome:

After successful completion of the course the students :

1. Become familiarize with instruments,and determine the strength of different acids.
2. Know about how to determine energy of activation.
- 3.Learn about analysis of water sample.
- 4.Understand about preparation of standered solutions.

Note : least eight experiments be completed (six from Section-A & two from Section–B)

A) Physical Chemistry (Instrumental)

- i) Determine the normality and strength of strong acid (HCl/H₂SO₄/HNO₃) conductometrically using standard solution of NaOH
- ii) Determine the normality and strength of weak acid (CH₃COOH/HCOOH) conductometrically using standard solution of NaOH
- iii)Determine the normality and strength of strong acid and weak acid in the given mixture conductometrically using standard solution of NaOH
- iv)To determine the solubility of a sparingly soluble salts (BaSO₄/ PbSO₄/ AgCl) conductometrically at room temperature.
- v) To Determine the of Stoichiometry of a complex by using colorimeter.
- vi)To verify Lambert-Beer law for KMnO₄ and determine the concentration of the given solution

of KMnO_4 .

B) Physical Chemistry (Non-Instrumental)

- 1) To study the effect of solute (NaCl) on the CST of phenol-water system and hence determine the amount of solute in the given sample of phenol-water composition.
- 2) To determine the radius of a molecule (Glycerol) by viscosity measurement method.
- 3) To study the effect of addition of electrolyte (KCl/NaCl) on solubility of weak organic acid at room temperature.
- 4) To determine the solubility of benzoic acid in water at different temperature (at least three temperature by difference of 10°C) and have its heat of solution.
- 5) To study the Partition coefficient of iodine between water and carbon tetrachloride.

B) Inorganic Chemistry

- i) Estimate the amount iron by external and internal indicator method using standard $\text{K}_2\text{Cr}_2\text{O}_7$ solution
- ii) Analyse the water sample for temporary hardness, permanent hardness and total hardness by EDTA method.
- iii) Prepare the standard solution of oxalic acid and estimate the amount of KMnO_4 in the given solution
prepare the standard solution of $\text{K}_2\text{Cr}_2\text{O}_7$ and estimate the amount of Iodine in the given solution

B. Sc. Second Year Chemistry
Laboratory Course – IV
Paper Code: U-CHE-354

Marks: 50
Credit: 01

Periods: 45
Weeks: 06

Learning Objective:

1. To prepare derivatives of organic compounds and understand about TLC
2. Perform quantitative analysis of organic compound
3. Preparation of different complexes and estimate the inorganic ions gravimetrically and volumetrically.

Course Outcome:

After successful completion of the course the students will :

1. Prepare derivatives of organic compounds and understand about TLC
2. Perform quantitative analysis of glucose, phenol, formaldehyde etc.
3. Prepare of different complexes like ferrous alum double salt, cupra ammine sulphate complex etc.

A) and estimate their inorganic ions gravimetrically and volumetrically **Organic Chemistry**

Preparations : (Any four)

- a) Acetylation : Preparation of Acetanilide from Aniline / Preparation of Aspirin.
- b) Imide formation : Preparation of phthalimide from phthalic anhydride.
- c) Electrophilic substitution reaction : Preparation of P – bromoacetanilide (Bromination)
- d) Formation of Anhydride : Preparation of phthalic anhydride from phthalic acid.
- e) Hydrolysis : Preparation of benzoic acid from benzamide.
- f) Reduction: Preparation of m – nitroaniline from m – dinitrobenzene.

B) Organic Quantitative Analysis : (Any four)

- i) Estimation of glycine by Sorensens method
- ii) Estimation of Glucose
- iii) Estimation of phenol
- iv) Estimation of formaldehyde

v) Estimation of crotonic acid (unsaturation)

vi) Estimation of Amide

B Inorganic Chemistry

- a Preparation of ferrous alum double salt and estimation of the amount of iron volumetrically
- b Preparation of potash alum double salt and estimation of the amount of aluminium by EDTA
- c Preparation of tetraamminecopper(II) sulphate complex and estimation of the amount of copper iodometrically
- d Preparation of potassium trioxalato aluminate complex and estimation of aluminium as aluminium oxinate gravimetrically.

B. Sc. Second Year (Semester – IV)
Paper – VII
Paper Code: U-CHE-451
Physical and Inorganic Chemistry (Section A + B)

Marks: 50
Credit: 02

Periods: 45
weeks: 06

Learning Objective:

1. Introduce the students with Collision theory of reaction rates, effect of temperature on reaction rates and Arrhenius equation numerical.
2. To understand concept of electrochemistry, Conductivity cell, Strong and weak electrolytes etc.
3. To learn about important terms in thermodynamics, First and second laws of thermodynamics, Carnot's cycle etc.
4. To familiarize with theories of coordination compounds, Postulates of VSEPR theory and its applications.

Course Outcome:

After successful completion of the course the students will :

1. Understand the Collision theory of reaction rates, effect of temperature on reaction rates and Arrhenius equation numerical.
2. Know concept of electrochemistry, Conductivity cell, Strong and weak electrolytes etc.
3. Understand about important terms in thermodynamics, First and second laws of thermodynamics, Carnot's cycle etc.
4. Familiarize with theories of coordination compounds, Postulates of VSEPR theory and its applications.

Section A : Physical Chemistry

Unit - I Chemical Kinetics – II :

07 Periods

- a) Collision theory of reaction rates
- b) Effect of temperature on reaction rates and Arrhenius equation, numericals
- c) Activated complex theory (ACT) of bimolecular reaction Iyring equation
- d) The Lindemann theory of unimolecular gaseous reaction
- e) Complex reactions (Brief view)

- f) Kinetics of : i) Opposing (Reversible) reactions
ii) Consecutive reactions

Unit-II Electrochemistry-I

- a) Introduction : Conduction of electricity, Types of conductors – electronic and electrolytic
b) Basic terms used in electrochemistry – Conductance, Specific conductance, Equivalent conductance, Molar conductance
c) Effect of dilution on various types of conductance
d) Conductivity cell, cell constant and its determination
e) Strong and weak electrolytes – Arrhenius theory, Debye Huckel theory, Debye – Huckel Onsger equation.
f) Brief view of transport numbers
g) Kohlrausch law and its applications
h) Conductometric titrations and its advantages i) Numerical problems on Kohlrausch law

Unit III Thermodynamics-I

- a) Introduction, terms and definitions: Internal energy, enthalpy, Heat, Work , etc., Thermodynamic processes.
b) Heat capacity, heat capacity at constant pressure and volume, relation between C_p & C_v
c) Introduction to first law of thermodynamics
d) Joules law, Joule-Thomson effect: qualitative discussion and experimentation, inversion temperature, Joule-Thomson Coefficient. (Numerical expected)
e) Need for second law of thermodynamics, Statements.
f) Carnot's cycle, efficiency of Carnot's engine, Carnot's theorem.
g) Concept of entropy
i) Introduction, Definition, Mathematical expression, Unit, Characteristics
ii) Entropy changes for an ideal gas as a function of V and T, P and T
iii) Entropy changes in physical transformation
iv) Entropy changes of an ideal gas in various processes
v) Physical significance of entropy, Entropy as criteria of Spontaneity.
h) Numerical on: Efficiency of Carnot's cycle, Entropy changes in physical transformations, Entropy changes of an ideal gas in different processes.

Section B : Inorganic Chemistry

Unit - I Coordination Chemistry-II :

08 Periods

Theories of coordination compounds :

- Werner's coordination theory, Sidgwick theory of effective atomic number rule, Pauling's theory – Interpretation of geometry and magnetic properties of coordination compounds such as $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{NiCl}_4]^{2-}$, $[\text{Ni}(\text{CO})_4]$, $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$. Ex. sp^3d^2 , d^2sp^3
- Crystal field theory – Postulates, splitting of d-orbitals in octahedral and tetrahedral fields, High spin and low spin complexes, Interpretation of colour and magnetic properties comparison of Valence Bond Theory and Crystal Field Theory

Unit - II VSEPR Theory :

(07 Periods)

- Introduction
- Postulates of VSEPR theory : explanation and limitations .
- Regular and irregular geometries.
- Shape of CH_4 , NH_3 & H_2O molecule
- Shape of sulphate ion SO_4^{2-} , chlorate ion ClO_3^- and perchlorate ion ClO_4^-

Physical Chemistry

- University General Chemistry By C.N.R. Rao
- Principles of Physical Chemistry By Maron and Prutton
- Physical Chemistry by G.M. Barrow
- Essentials of Physical Chemistry by Bhal and Tuli
- Elements of Physical Chemistry by Glasston and Lewis
- Physical Chemistry by Robert A. Alberty
- Principles of Physical Chemistry by Puri, Sharma, Pathania
- Advanced Physical Chemistry by Harish Gurdeep

- 17) Physical Chemistry by W.J. Moor
- 18) Chemical Kinetics by K.J. Laidler
- 19) Text book of Physical Chemistry by Soni, Dharmarha
- 20) Advanced physical chemistry by D.N. Bajpai
- 21) Text book of Physical Chemistry by S. Glasston
- 22) Text book of Physical Chemistry by A.S. Negi

Inorganic Chemistry

- 14) Principles of Inorganic Chemistry by Puri – Sharma – Kaliya
- 15) Inorganic Chemistry by Gurudeep Raj and Chatwal Anand
- 16) Advanced Inorganic Chemistry Vol. - I and Vol. - II by Satyaprakash, Tuli, Basu and Madan
- 17) Concise Inorganic Chemistry by J.D. Lee
- 18) Inorganic Chemistry by A.G. Sharp
- 19) Inorganic Chemistry by G.L. Miessler and D.A. Tarr
- 20) Inorganic Chemistry by Day and Selbin
- 21) Structural Chemistry by A.F. Wells
- 22) Coordination Chemistry by Kettle
- 23) Text book of Inorganic Chemistry by – P.L. Soni

B. Sc. Second Year Chemistry

(Semester IV)

Paper – VIII

Paper Code : U-CHE-452

Organic and Inorganic Chemistry (Section A+B)

Marks: 50

Periods: 45

Credit: 02

Weeks: 06

Learning Objective:

1. To familiarize the students with concept of stereochemistry, stereoisomerism, chirality etc.
2. To write the reactions of preparations of carbohydrates with mechanism
3. To understand about Polymers, types of polymerization, physical and chemical properties of oils and fats.
4. Know about Principles involved in gravimetric analysis, unit operations in gravimetric analysis.
5. To understand about types of corrosion, theory of corrosion.

Course Outcome:

After successful completion of the course the students will :

1. Familiarize the students with concept of stereochemistry, stereoisomerism, chirality etc.
2. Write the reactions of preparations of carbohydrates with mechanism
3. Understand about Polymers, types of polymerization, physical and chemical properties of oils and fats.
4. Know about, Precipitation, filtration, unit operations in gravimetric analysis.
5. Understand about types of corrosion, theory of corrosion, factors affecting on corrosion

Section A: Organic Chemistry

Unit:-I

Stereochemistry

08 periods

1.1 Introduction

1.2 Concept and Types of isomerism

a) Structural isomerism

b) Stereo isomerism

1.3 Types of structural isomerism [Chain, Position, Functional, Metamerism, Tautomerism]

1.4 Types of Stereoisomerism [Conformational (n-butane) and Configurational]

1.5 Geometrical isomerism: Cis -Trans and E and Z system of nomenclature.

1.6 Optical isomerism:

a) Concept of asymmetric carbon atom & Chiral centre

b) Dextro, Laevo forms & Racemic mixture

c) Element of symmetry [plane, Centre, and Axis]

d) Concept of Diastereoisomers

e) Racemic modification (with one example)

f) Resolution concept (with one example)

g) Walden inversion (with one example)

h) Relative Configuration and Absolute configuration [D,L and R,S notations]

Unit:-II

Carbohydrates

08 periods

2.1 Introduction

2.2 Classification and Nomenclature

2.3 Reactions of Monosaccharide's (Glucose and Fructose)

a) Addition reactions

b) Ether formation

c) Reduction of glucose

d) Oxidation of glucose

e) Osazone formation with mechanism

2.4 Open and cyclic structure of glucose

2.5 Determination of ring size

2.6 Mutarotation with Mechanism

2.7 Epimerization

2.8 Cyclic Structure of D-glucose (Supporting evidence for six member ring)

2.9 Interconversion:

a) Glucose to Fructose

b) Fructose to Glucose

c) Glucose to Mannose

d) Glucose to Arabinose (Ruff Degradation)

e) Arabinose to Glucose (Kiliani synthesis)

2.10 Pyranose Structure of Glucose

2.11 Manufacturing of sucrose (sugar) from sugar cane

Unit:- III Aromatic Carboxylic and Sulphonic Acids

08 periods

3.1 Aromatic Carboxylic acids:

3.1.1 Introduction and Classification of Aromatic Carboxylic Acids

3.1.2 Synthesis and Chemical Reactions of Following Acids

A] Benzoic Acid:

3.1.3 Preparations From:

a) Phenyl Cyanide

b) Toluene

3.1.4 Reactions of Benzoic Acids:

a) Acyl halide formation

b) Reduction

C) Nitration

B] Anthranilic Acid:

3.1.5 Preparations From :

a) Phthalimide

b) o-nitroToluene

3.1.6 Reactions of Anthranilic Acids:

a) Action of heat

b) Nitrous Acid

c) Action of acetic anhydride/acetyl chloride

C] Salicylic Acid:

3.1.7 Preparations From:

a) Kolbe's reaction

b) Reimer-Tiemann reaction

3.1.8 Reactions of Salicylic Acids:

a) Bromination

b) Nitration

- a) Oxidation
- b) Diels–Alder reaction
- c) Electrophilic substitution reactions

Section B : Inorganic Chemistry

Unit - I Principles involved in gravimetric analysis :

10 Periods

- 1.1 Introduction
- 1.2 Unit operations in gravimetric analysis
- 1.3 Precipitation – Types of precipitants (organic & inorganic), conditions for complete precipitation, types of precipitates, common ion effect, solubility product, factors affecting precipitation
- 1.4 Purity of precipitates – Co-precipitation, Post-precipitation, Difference between Co-precipitation and Post - precipitation
- 1.5 Digestion of the precipitate (Ageing)
- 1.6 Filtration
- 1.7 Washing of the precipitate, Choice of wash liquid, Properties of good wash liquid
- 1.8 Drying of precipitate
- 1.9 Incineration and ignition of the precipitate
- 1.10 Weighing of the precipitate and Gravimetric Conversion Factor (GCF)

Unit - II Corrosion and Passivity :

(05 Periods)

A) Corrosion

- 2.1 Definition of corrosion of metal
- 2.2 Types of corrosion – i) Atmospheric ii) Immersed
- 2.3 Theory of corrosion – Electrochemical theory
- 2.4 Factors affecting corrosion :
 - i) Position of metal in electro chemical series
 - ii) Purity of metal
 - iii) Effect of moisture
 - iv) Effect of oxygen
 - v) Effect of pH
 - vi) Physical state of metal
- 2.5 Methods of prevention of corrosion of metals :

i) Purification of metal

ii) Alloy formation

iii) Making metal cathodic

B) Passivity

2.6 Passivity-Definition

2.7 Theories of Passivity :

i) Oxide film theory

ii) Gaseous film theory

B. Sc. Second Year Chemistry (Semester IV)
Laboratory Course - V
Paper Code : U-CHE-453

Marks : 50

Periods : 45

Learning Objective:

1. To practice instrumental analysis involving potentiometer.
2. To determine normality, redox potential potentiometrically.
3. To find out precher , radius of a molecules.
4. Estimations of ions gravimetrically.

Course Outcome:

After successful completion of the course the students will :

1. Perform instrumental analysis involving potentiometer.
2. Can determine normality, redox potential potentiometrically.
3. Find out precher , radius of a different molecules.
4. Can estimates the ions gravimetrically.

Note : least eight experiments be completed (six from Section-A & two from Section-B)

A) Physical Chemistry (Instrumental)

- i) To determine the normality and strength of strong acid (HCl/H₂SO₄/HNO₃) potentiometrically using standard solution of NaOH
- ii) To determine the redox potential of Fe³⁺/Fe²⁺ system by titrating it with standard KMnO₄ potentiometrically.
- iii) Estimation of amount of Fe²⁺ and Fe³⁺ in the given mixture potentiometrically using standard K₂Cr₂O₇ solution.
- iv) To determine the dissociation constant of weak acid potentiometrically by titrating it against alkali.
- v) To determine indicator constant of indicator by using colorimeter.
- vi) To determine the specific rotation of a given optically active compound.

Physical Chemistry (Non-Instrumental)

- i) To Determine the energy of activation of reaction between KI and K₂S₂O₈.
- ii) To determine the equilibrium constant for the reaction: $KI + I_2 \longrightarrow KI_3$.
- iii) To study the rate of acid catalysed iodination of acetone.

iv) To determine the surface tension of methyl alcohol, ethyl alcohol & n-hexane at room temperature & also calculate atomic parachors of carbon, hydrogen & oxygen.

v) Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

B) Inorganic Chemistry

i) Estimate the amount of iron in the given solution gravimetrically

ii) Estimate the amount of sulphate ion in the given solution gravimetrically

iii) Estimate the amount of Barium as barium chromate gravimetrically

iv) Estimate the amount of Nickel as Ni-DMG complex gravimetrically

B. Sc. Second Year Chemistry (Semester IV)
Laboratory Course - VI
Paper Code : U-CHE-454

Marks:50

Periods : 45

Learning objective:

1. To perform organic qualitative analysis of acids, phenols, base, neutral molecules.
2. To separate binary mixture and estimate inorganic ion by volumetrically.

Course Outcome:

1. Students can perform organic qualitative analysis of acids, phenols, base, neutral molecules.
2. They can separate binary mixture and estimate inorganic ion by volumetrically

Note : least eight experiments be completed (six from Section-A & two from Section-B)

A) Organic Chemistry

Organic Qualitative Analysis: At least eight compounds be selected from the following list (Preliminary test, Nature, Elemental analysis, Functional group detection, Physical constant & preparation of derivatives)

- Acids – Benzoic acid, Salicylic acid, Cinnamic acid, Phthalic acid
Phenols - α - Naphthol, β - Naphthol
Base - o – Nitro aniline, p – Nitro aniline, m – Nitro aniline, aniline
Neutral - Naphthalene, Anthracene, Acetanilide, m-dinitrobenzene,
Benzaldehyde, Acetophenone

B) Inorganic Chemistry

Separation of binary mixture and estimation of any one component by volumetric method.

- | | |
|--|---------------------------------------|
| i) $\text{Cu}^{2+} - \text{Zn}^{2+}$ | ii) $\text{Mn}^{2+} - \text{Zn}^{2+}$ |
| iii) $\text{Ba}^{2+} - \text{Ca}^{2+}$ | iv) $\text{Fe}^{3+} - \text{Al}^{3+}$ |

References :

Organic Chemistry

- 11) Organic Chemistry – S.M.Mukherji, S.P.Singh, R.P.Kapoor (Vol. I & II)
- 12) Organic Chemistry by – Jagdambasingh, L.D.S.Yadav (Vol. I & II)
- 13) A text book of Organic Chemistry by – P.L.Soni
- 14) A text book of Organic Chemistry by – K.S.Tewari, S.N.Mehrotra, N.K.Vishnoi
- 15) A text book of Organic Chemistry by – Arun Bahl & B.S.Bahl
- 16) Principles of Organic Chemistry by – M.K.Jain
- 17) Organic Chemistry by – Morrison and Boyd
- 18) Organic Chemistry by – Carey
- 19) Advanced Organic Chemistry by – Jerry March
- 20) Organic Reactions and their Mechanisms by – P.S.Kalsi
- 21) A text book of Organic Chemistry by G.K.Ahluwalia, Madhuri Goyal

Inorganic Chemistry

- 24) Principles of Inorganic Chemistry by Puri – Sharma – Kaliya
- 25) Inorganic Chemistry by Gurudeep Raj and Chatwal Anand
- 26) Advanced Inorganic Chemistry Vol. - I and Vol. - II by Satyaprakash, Tuli, Basu and Madan
- 27) Concise Inorganic Chemistry by J.D. Lee
- 28) Inorganic Chemistry by G.L. Miessler and D.A. Tarr
- 29) Inorganic Chemistry by Day and Selbin
- 30) Structural Chemistry by A.F. Wells
- 31) Coordination Chemistry by Kettle
- 32) Text book of Inorganic Chemistry by – P.L. Soni

Practical Chemistry

- 1) Vogel's Qualitative Analysis
- 2) A Text book of Practical Chemistry for B.Sc. By V.V. Nadkarny A.N. Kothari and Y.V. Lawande
- 3) Advanced Practical Inorganic Chemistry by O.P. Agarwal
- 4) Vogel's Quantitative Analysis

- 5) Practical Organic Chemistry by A.I. Vogel
- 6) Advanced Practical Organic Chemistry by O.P. Agarwal
- 7) Advanced Practical Organic Chemistry by N.K. Vishnoi
- 8) Experimental Physical Chemistry by A. Findlay
- 9) Advanced Practical Physical Chemistry by J.B. Yadav
- 10) Experiments in Physical Chemistry by R.C. Das and B. Behra
- 11) Advanced experimental chemistry Vol-I, II and III by J.N. Gurutu and R. Kapoor
- 12) Systematic experimental Physical Chemistry by S.W. Rajbhoj and Chondekar
- 13) Experimental in Physical Chemistry by J.C. Ghosh
- 14) Practical Physical Chemistry by B.D. Khosala and V.C. Garg
- 15) Experiments in Chemistry by D.V. Jahagirdar
- 16) Practical Chemistry, Physical – Inorganic – Organic and Viva-Voce by Balwantraai Satuja
- 17) College Practical Chemistry by H.N. Patel, S.R. Jakal H.P. Subhedar P.P. Turakhia
