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LATUR – 413512

DEPARTMENT OF CHEMISTRY

Syllabus

B.Sc. (Second Year) Chemistry
CBCS Pattern

(III & IV Semester)

With Effect From 2018-2019

B.Sc. Second Year (Semester – III)
CORE COURSE CHEMISTRY

Paper	Course Code	Course Title	Periods Per Week	Total Periods	Marks	Credits
V	U-CHE-351	Physical and Inorganic Chemistry	03	45	50	02
VI	U-CHE-352	Organic and Inorganic Chemistry	03	45	50	02
III	U-CHE-353	Laboratory Course - III	03	45	50	01
IV	U-CHE-354	Laboratory Course – IV	03	45	50	01
	SEC-I	Skill Enhancement Course –I	03	45	50	02
		Total			**250**	**08**

B.Sc. Second Year (Semester – IV)
CORE COURSE CHEMISTRY

Paper	Course Code	Course Title	Periods Per Week	Total Periods	Marks	Credits
VII	U-CHE-451	Physical and Inorganic Chemistry	03	45	50	02
VIII	U-CHE-452	Organic and Inorganic Chemistry	03	45	50	02
V	U-CHE-453	Laboratory Course – V	03	45	50	01
VI	U-CHE-454	Laboratory Course – VI	03	45	50	01
	SEC-II	Skill Enhancement Course –II	03	45	30	01
		Total			**250**	**08**

B.Sc. Second Year (Semester – III)
Paper – V
Paper Code: U-CHE-351

Physical and Inorganic Chemistry (Section A)

Marks: 50 **Periods: 45**
Credit: 02 **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 C_{60} (Fullerene)**.**

Section A: Physical Chemistry & Inorganic Chemistry

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) Chemiluminiscence 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 : H_2O, Sulphur and CO_2 system

c) Two component system : Pb-Ag system, de-silverisation of lead (Parke's process), KI-H_2O 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.

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)

B.Sc. Second Year Chemistry(Semester III)

Paper – VI

Paper Code : U-CHE-352

Organic and Inorganic Chemistry (Section 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.

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 Br_2 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 (-NO_2, -OCH_3, -CH_3) 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 CO_2.

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 [$(C_2H_5)_2Zn$]

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-defination, 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

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

Marks: 50 **Periods: 45**
Credit: 01 **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.Uunderstand about preparation of standered solutions.

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

A) Physical Chemistry (Instrumental)

1) Determine the normality and strength of strong acid ($HCl/H_2SO_4/HNO_3$) conductometrically using standard solution of NaOH

2) Determine the normality and strength of weak acid ($CH_3COOH/HCOOH$) conductometrically using standard solution of NaOH

3) Determine the normality and strength of strong acid and weak acid in the given mixture conductometrically using standard solution of NaOH

4) To determine the solubility of a sparingly soluble salts (BaSO4/ PbSO4/ AgCl) conductometrically at room temperature.

a. To Determine the of Stoichiometry of a complex by using colorimeter.
b. To verify Lambert-Beer law for KMnO4 and determine the concentration of the given

solution of KMnO4.

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 10^0C) and have its heat of solution.
5) To study the Partition coefficient of iodine between water and carbon tetrachloride.
6) To construct the phase diagram of three component system(Acetic acid-chloroform-water)

B) Inorganic Chemistry

i) Estimate the amount iron by external and internal indicator method using standard $K_2Cr_2O_7$ 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

iv) Prepare the standard solution of $K_2Cr_2O_7$ and estimate the amount of Iodine in the given solution

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

Marks: 50 **Periods: 45**
Credit: 01 **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 complexs 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 complexs like ferrous alum double salt , cupra ammine sulphate complexetc. and estimate their inorganic ions gravimetrically and volumetrically

A) **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) Hydrolsis : 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

C) 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 tetraaminecopper(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 II Year (Semester III)

Skill Enhancement Course-I

Course title: SOIL SCIENCE, FERTILIZERS and MICRONUTRIENTS

Marks: 30 **Credites: 02**

Learning Objective:

1. Familiarize students with, Properties and Composition of Soils, Effects of modern agro – technology and pesticides on soil

2. To know the Classification and types of fertilizers, , Bricakating technology of fertilizers

3. To Understand Properties and Uses of Micro- nutrients, Plant Growth promoters and hormones

Course Outcome:

After successful completion of the course the students will :

1. Familiarize students with, Properties and Composition of Soils, Nitrogen fixation, and Soil reclamation etc.

2. They Understands about Essential fertility requirement of the Nitrogenous,Phosphate Fertilizers.

3. They will know about Gibberellins , Auxins, Cytokinins , Ethylene

Unit- I Soil Science **(15Periods)**

Importance of Soil formation, Properties and Composition of Soils, Soil profile, Organic matter in soil, Soil micronutrients, Acid and Alkaline soil, Absorption of toxic metal and chemicals by soil, Effects of modern agro –technology and pesticides on soil, Nitrogen fixation, and Soil Reclamation, Study on N, P, K , and S transformations, Leaching, Run off, Absorption of water and ground water.

Unit-II Fertilizers **(15Periods)**

Classification and types of fertilizers, Essential fertility requirement of the Nitrogenous fertilizers: Ammonium nitrate, Urea, Calcium Cyanamide, Calcium Ammonium Nitrate, Sodium Nitrate, Ammonium Chloride: Introduction, Raw materials, Manufacture, Action of as a fertilizers.

Phosphate fertilizers: Normal super phosphate, Triple Super Phosphate, Ammonium Phosphate. Potassic fertilizers, Bricakating technology of fertilizers, Mixed fertilizers and positions of Fertilizer Industries in India.

Unit-III Micronutrient and Growth Regulators **(15Periods)**

A) Micro nutrients

Definition, Types, Properties and Uses of Micro- nutrients, Manufacture of Micronutrients, Deficiency and Reclamation.

B) Plant Growth promoters and hormones

a) Gibberellins b) Auxins

c) Cytokinins d) Ethylene

B.Sc. Second Year Chemistry
Skill Enhancement Lab Course-I

Marks: 20 **Weeks: 06**

1. Determination of moisture in soil
2. Determination of specific gravity of soil
3. Determination of available P by Olsen's method (kg/ha)
4. Determination of available K by ammonium acetate method (kg/ha)
5. Estimation of total P_2O_5content in fertilizer.
6. Estimation of potassium content (soil/fertilizer) by flame photometer.
7. Determination of pH and conductivity of soil sample.
8. Estimation of Phosphorous from soil by colorimetric method
9. Estimation of nitrogen from soil by Kjeldahals method
10. Determination of ammonium sulphate in a given fertilizer sample spectrophotometrically using Nessler's reagent.

Reference Books:

1. Bear : Chemistry of the soil (ACS Remhold)
2. M. B. Green, G. S. Hartley and T. F. West: Chemicals for crop improvement and pest management (Pergamon).
3. D. N. Shreve: The Chemical process Industries.
4. W. L. Badger and J. T. Bandhiro: Introduction to chemical Engineering (McGraw Hill).M. Deshmukh:Biofertilizers
5. Gopal Rao: Outlines in Chemical Technology.
6. Shukla and Pandey: Introduction to Chemical Technology.
7. B. K. Sharma: Industrial Chemistry by B.K.Sharma.
8. Outline in Chemical Technology by Gopal Rao
9. Introduction to Chemical Technologyby Shukla and Pandey.
10. Industrial Chemistry by B. K. Sharma.
11. Methods of Pesticides analysis -U. S. Sree Ramulu, Oxford-IBH
12. Pesticides, Plant Growth Regulators and Food Additives, Vol I to XI -Gunter ZweigAcademicpress
13. A textbook of Practical Organic Chemistry -A. I. Vogel-ELBS with Longman, 5thEd., (1989)
14. Laboratory Manual of Organic Chemistry -R.K.Bansal-Wiley Eastern 3rd(1994) 5.
15. Advanced Practical Organic Chemistry -N.K. Vishnoi -Vikas
16. Applications of Absorption Spectroscopy of Organic Compounds-J.R.Dyer-Prentice Hall
17. Spectroscopic methods in Organic Chemistry -D.H.Williams & I Flemming (McGraw Hill)
18. CIPAC Hand Book Volume F Analysis of Technical and Formulated Pesticides Editors : W Dobrat A Martijn Pub : Collaborative International Pesticides Analytical Council Limited England 1994.

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

Marks: 50 **Periods: 45**
Credit: 02 **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
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.

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 – Arrehenius 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 definations: Internale energy, enthalpy, Heat, Work , etc.,Thermodynamic processes.

b) Heat capacity, heat capacity at constant pressure and volume, relation between Cp & Cv

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.

b. Inorganic Chemistry

Unit - I Coordination Chemistry-II : 08 Periods

Theories of coordination compounds :

a) Werner's coordination theory, Sidgwick theory of effective atomic number rule, paulings theory – Interpretation of geometry and magnetic properties of coordination compounds such as $[Ni(CN)_4]^{2-}$, $[NiCl_4]^{2-}$, $[Ni(CO)_4]$, $[Co(NH_3)_6]Cl_3$. Ex. Sp^3d^2, d^2sp^3

b) 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

a) Introduction

b) Postulates of VSEPR theory : explanation and limitations .

c) Regular and irregular geometries.

d) Shape of CH_4, NH_3 & H_2O molecule

e) Shape of sulphate ion SO_4^{2-} , chlorate ion ClO_3^- and perchlorate ion ClO_4^-

B.Sc. Second Year Chemistry

(Semester IV)

Paper – VIII

Paper Code : U-CHE-452

Organic and Inorganic Chemistry (Section A)

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

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

D] Phthalic Acid:

3.1.9 Preparations From:

a) o-xylene b) Naphthalene

3.1.10 Reactions of Phthalic Acids:

a) Action of heat b) Action of PCl_5 C) Action of ethanol

3.2 Benzene Sulphonic Acid

3.2.1 Introduction.

3.2.2 Preparation of benzene sulphonic acid from benzene with mechanism.

3.2.3 Chemical Reactions of benzene sulphonic acid

a) Salt formation b) formation of sulphonyl chloride

c) formation of sulphonic ester and amide

3.2.4 Replacement of sulphonic group by:

a) Hydroxyl group b)cyano group

c) Hydrogen atom d) NH_2–group

Unit – IV

Polynuclear Hydrocarbons : 06 Periods

4.1 Polynuclear Hydrocarbons:

4.1.1 Introduction and Classification:

A] Naphthalene :

4.1.2 Isolation from Coal tar

4.1.3 Synthesis from:

a) 4 – phenylbut-1-ene b) Haworth's synthesis

4.1.4 Physical Properties :

4.1.5 Chemical Properties:

a) Reduction b) Electrophilic substitution reactions

B] Anthracene :

4.1.6 Isolation from Coal tar

4.1.7 Synthesis from:

a) Naphthaquinone b) o-bromobenzyl bromide

4.1.8 Physical Properties & Chemical properties:

a) Oxidation b) Diels–Alder reaction

c) Electrophilic substitution reactions

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 preventation 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 **Credites:01**

Learning Objective:

1. To practice instrumental analysis involving potentiometer.
2. To determine normality,redox potential potentiometrically.
3. To find out preacher , 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 preacher , 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 ($HCl/H_2SO_4/HNO_3$) potentiometrically using standard solution of NaOH
ii) To determine the redox potential of Fe^{3+}/Fe^{2+} system by titrating it with standard $KMnO_4$ potentiometrically.
iii) Estimation of amount of Fe^{2+} and Fe^{3+} in the given mixture potentiometrically using standard $K_2Cr_2O_7$ 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) Determine the energy of activation of reaction between KI and $K_2S_2O_8$.

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

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

Marks: 50 **Periods : 45**
Credites:01

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) Cu^{2+} - Zn^{2+} ii) Mn^{2+} -Zn^{2+}
iii) Ba^{2+} - Ca^{2+} iv) Fe^{3+} - Al^{3+}

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) Organic Chemistry by – Clayden-Greeves, Warren and Wothers
8) Organic Chemistry by – Morrison and Boyd
9) Organic Chemistry by – Carey
10) Advanced Organic Chemistry by – Jerry March
11) Organic Reactions and their Mechanisms by – P.S.Kalsi
12) A guide book to Mechaism in organic chemistry by – Peter Sykes
13) Organic Chemistry by – I.L.Finar
14) Fundamentals of Organic Chemistry Solomon and T.W.Graham.
15) A text book of Organic Chemistry by G.K.Ahluwalia, Madhuri Goyal

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 Huheey, Keiter and Keiter
5) Concise Inorganic Chemistry by J.D. Lee
6) Inorganic Chemistry By Shriver and Atkins
7) Inorganic Chemistry By T. Moeller
8) Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and P.L. Gaus
9) Inorganic Chemistry by A.G. Sharp
10) Inorganic Chemistry by G.L. Miessler and D.A. Tarr
11) Inorganic Chemistry by Day and Selbin

12)Structural Chemistry by A.F. Wells

13)Coordination Chemistry by Kettle

14)Text book of Inorganic Chemistry by – P.L. Soni

Physical Chemistry

1) University General Chemistry By C.N.R. Rao
2) Principles of Physical Chemistry By Maron and Prutton
3) Physical Chemistry by G.M. Barrow
4) Essentials of Physical Chemistry by Bhal and Tuli
5) Elements of Physical Chemistry by Glasston and Lewis
6) Physical Chemistry by Robert A. Alberty
7) Principles of Physical Chemistry by Puri, Sharma, Pathania
8) Elements of Physical Chemistry by P.W. Atkins
9) Advanced Physical Chemistry by Harish Gurdeep
10) Physical Chemistry by W.J. Moor
11) Physical Chemistry by A.J. Mee
12) Chemical Kinetics by K.J. Laidler
13) Text book of Physical Chemistry by Soni, Dharmarha
14) Advanced physical chemistry by D.N. Bajpai
15) Text book of Physical Chemistry by S. Glasston
16) Text book of Physical Chemistry by A.S. Negi

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 Balwantrai Satuja

17) College Practical Chemistry by H.N. Patel, S.R. Jakal H.P. Subhedar P.P. Turakhia

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B.Sc II Year (Semester IV)

Skill Enhancement Course-II

Course Title: Pesticides and Insecticides

Marks: 30 **Credites:02**

Learning Objective :

1. To familiarize the students with Classification of pesticides , History of pesticides, innovation of pesticides chemistry.
2. To understand the concept of Insecticides, Manufacturing processes of some pesticides: Lindane (BHC), DDT, Parathion, Phorate.

Course Outcome:

1. Students will understand the concept ,Chemical nature of pesticides , History of pesticides etc.
2. They will know the Manufacturing processes of some pesticides: like Lindane (BHC), DDT, Parathion, Phorate.

Unit I: : Pesticides **(15 Periods)**

Definition, importance & general classification of agrochemicals. Classification of pesticides on chemical nature and according to target species, mode of action.
Introduction: History of pesticides, innovation of pesticides chemistry, development of pesticides.

Unit II: Chemistry of Pesticides **(15 Periods)**

Brief introduction to classes of pesticides, structure, chemical name, physical properties, chemical properties, synthesis, degradation, metabolism, formulations, mode of action, uses, toxicity (acute and chronic toxicity in mammals, birds, aquatic species etc.), methods of analysis.

Unit II: **Insecticides** **(15 Periods)**

Introduction, Acephate, Bifentrin, Buprofezin, Cartap hydrochloride , Chlorpyriphos ,Decamethrin, Dimethoate, Endosulfan, Fenvalerate, Imadichloprid, Indoxacarb, Methomyl, Monocrotophos, Parathion-methyl, Propoxur, Pyrethrin, Quinolphos, Temephos, Thiamethoxam,.Manufacturing processes of some pesticides: Lindane (BHC), DDT, Parathion, Phorate.

B.Sc. Second Year Chemistry
Skill Enhancement Lab Course-II

Marks: 20 **Weeks: 06**

1. Estimation of available chlorine in bleaching powder
2. Determination of bulk density of pesticidal WP/WDG/Dust/SP.
3. Determination of copper from Bordeaux mixture as fungicides by iodometric titration.
4. Estimation of Organophosphorus insecticide residues in soil by visible spectroscopic.
5. Separation and detection of pesticide by thin layer chromatography.
6. Determination of emulsion stability and cold test of pesticide.
7. Synthesis of pesticides/analogs (Any Three)

a) Phenyl benzoate. b) Acetanilide
c) p-Bromoacetanilide d) p-Bromoaniline
e) Benzanilide. f) N, N-Diphenyl benzanilid

Recommended Books

1. Chemistry of Insecticides and Fungicides - U.S.Shree Ramulu Oxford & IBH Pub., 2nd (1995)
2. Pesticide Synthesis- P.S.Marg, G.K.Kohn, J.J.Menn
3. Chemical Weekly's Agrochemicals Dietionary
4. Handbook of Systemic Fungicides Vol- I,II,III - S.C.Vyas
5. Analytical Methods for Pesticides, Plant growth regulators & food additives. Vol.,I-IV Ed. By Gunter Zweig.
6. The Agrochemical Handbook - Royal: Society, England
7. Pesticide Science and Biotechnology - R. Greenhalgh and T.R.Roberts
8. Outlines of Chemical Technology - C.E.Dryden, Ed. by M.Gopal
9. Principles of Pesticide Chemistry- S. K .Handa, Ed. By Agrobios (India)
10. Pesticides- Ed. G.S. Dhaliwal and B. Singh
11. Pesticides in India- Recent facts and figure- R & D section, Yawalkar Pesticides, Nagpur (Agri-Horticulture, Nagpur) .
12. Chemistry of Pesticides - N. N. Melinkov, Springer.
13. Pesticides: preparation and mode of action- Cremlyn Dekker.
14. Methods of Pesticides analysis -U.S.Sree Ramulu, Oxford-IBH
15. Pesticides, Plant Growth Regulators and Food Additives, Vol I to IV-Gunter Zweig Academic press
16. A textbook of Practical Organic Chemistry -A.I.Vogel-ELBS with Longman, 5th Ed., (1989)
17. Laboratory manual of Organic Chemistry -R.K.Bansal-Wiley Eastern 3rd Ed., (1994)
18. Advanced Practical Organic Chemistry -N.K.Vishnoi -Vikas 2nd (1996)