## THIRUVALLUVAR UNIVERSITY

### B.Sc., CHEMISTRY DEGREE COURSE

#### CBCS PATTERN

(With effect from 2017 - 2018)

The Course of Study and the Scheme of Examinations

### SEMESTER I

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**SEMESTER V**

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# if Mathematics is one of the Allied Subjects total no. of papers will be 41.
THIRUVALLUVAR UNIVERSITY
B.Sc., CHEMISTRY SYLLABUS UNDER CBCS
(With effect from 2017 - 2018)

SEMESTER I

PAPER – 1 GENERAL CHEMISTRY – I

Objective:

UNIT-I ATOMIC STRUCTURE

1.1 Quantum numbers n, l, m and s – Pauli’s exclusion principle – Energy distribution and orbitals - Hund’s rule of maximum multiplicity - Aufbau's principle - Electronic Configuration of elements - Stability of Half-filled and completely filled orbitals.

1.2 Classification of elements – General characteristics of s, p, d and f- Block elements – Periodicity of properties- Definition and Periodicity of the following properties – Atomic radii and Ionic radii - Factors affecting the Atomic radii and Ionic radii.

1.3 Ionisation potential, Electron affinity and Electronegativity - Factors affecting the Ionisation potential, Electron affinity and Electronegativity – Pauling scale – Mulliken electronegativity scale – Applications of Electronegativity regarding the Bonding nature.
UNIT- II CHEMICAL BONDING

2.1 Ionic bond - Conditions for the formation of ionic bond - General properties – Energetics of formation of NaCl from Na⁺ and Cl⁻ - Hydration energy, Lattice energy and their applications – Born-Haber cycle - Fajan's rule - Characteristics of Electrovalent compounds.

2.2 Valence Bond Theory - Conditions for the formation of covalent bond - General properties - Polarity of bonds - Orbital overlap - Bond lengths and Bond energies - Hybridisation - Sigma and Pi bonds - VSEPR theory - Geometries of BF₃, NH₃, H₂O, PCl₅ and SF₆ molecules - Partial ionic character of covalent bond - Percentage of ionic character.

2.3 Molecular Orbital theory – Bonding and Anti-bonding orbitals - Relative order of Energies of molecular orbitals - MO diagram of H₂, He₂, O₂, N₂, F₂ and CO - Bond Order - Stability and Magnetic properties of the molecules - Comparison of VB and MO theories.

UNIT- III BASIC CONCEPTS OF ORGANIC CHEMISTRY


3.3 Cleavage of bonds - Homolytic and Heterolytic fission of carbon-carbon bond – Methods to determine the Reaction Mechanism - Reaction intermediates - Structure and Stability of Carbocations, Carbanions and Free radicals.
UNIT-IV STATES OF MATTER

4.1 Gaseous state - Kinetic gas equation - Derivation - Gas laws from the kinetic gas equation - Kinds of velocities - Mean, RMS, Most Probable Velocities - Calculation of molecular velocities - Maxwell's distribution of Molecular Velocities (No derivation) - Effect of Temperature on velocity distribution - Equipartition of energy - Heat capacity on molecular basis - Virial equation of state - Boyle temperature - Coefficient of Compressibility and Thermal expansion.

4.2 Liquid state - Density – Diffusion - Viscosity – Evaporation - Surface tension - Effect of temperature on surface tension - Parachor - Definition and Applications only - Coefficient of Viscosity - Effect of Temperature and Pressure - Liquid crystals - Classification and Molecular arrangements.


UNIT-V PRINCIPLES OF VOLUMETRIC ANALYSIS

5.1 Definitions of Molarity, Molality, Normality and Mole Fraction - Their Calculations - Definition and Examples for Primary and Secondary standards - Calculation of Equivalent Weight of Acid, Base, Oxidising Agent, Reducing Agent and Salts.

5.2 Principles of Volumetric Analysis - Theories of Acid- Base, Redox, Complexometric Iodometric and Iodimetric titrations.

5.3 Theories of indicators - Acid-base indicators - Choice of indicators - Redox, Metal ion and Adsorption indicators.
ALLIED

1. PHYSICS - I

UNIT – I: PROPERTIES OF MATTER


Surface Tension: Surface Tension – Surface Tension and interfacial surface tension by the method of drops.

UNIT – II: HEAT


UNIT – III: ELECTRICITY AND MAGNETISM


UNIT – IV: SOUND AND ACOUSTICS OF BUILDING


Ultrasonics – Production by Piezo – electric method – properties and uses.

Acoustics of buildings: Reverberation – Reverberation time – Sabine’s formula (definition only) – Sound absorption co-efficient of surface – conditions for the perfect acoustics.
UNIT – V: OPTICS

Interference: Air Wedge – Description – Test for optical flatness of glass plate – Determination of diameter of a thin wire by air wedge.


Fibre optics: principle-classification of optical fibres-fibre optic communication system block diagram.

Books for Study & Reference

2. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics – Prof. Dhanalakshmi and others.
ALLIED

3. ZOOLOGY I

Objective:

To acquire knowledge about different kinds of animal species.

To study the systematic and functional morphology of invertebrates and chordates.

UNIT – I:
Type study includes life history.

Platyhelminthes - Teania solium.

UNIT - II
Annelida - Earthworm, Arthropoda - Prawn, Mollusca - Fresh water mussel, Echinodermata - Sea star.

UNIT – III:
Type study includes Morphology, digestive system, respiratory system, circulatory system and urinogenital system of Chordate.


UNIT - IV

Amphibia: Frog, Reptiles: Calotes

UNIT - V

Aves: Pigeon, Mammalia: Rabbit.

REFERENCES:


4. BIOCHEMISTRY I

UNIT-I: Chemistry of Carbohydrates
Definition and Classification of carbohydrate. Monosaccharides - occurrence, structure; physical and chemical properties, linear and ring forms (Haworth formula) for glucose and fructose. Disaccharides - occurrence, structure; physical and chemical properties of sucrose and lactose. Polysaccharides - occurrence, structure, physical and chemical properties of starch.

UNIT-II: Chemistry of amino acids
Definition and classification of amino acids. Reaction with ninhydrin, common properties of amino acids, amphoteric nature, isoelectric point, isoelectric pH and Zwitter ion.

UNIT-III: Chemistry of Proteins
Classification based on solubility, shape and size. Physical properties: salting in and salting out, denaturation, peptide bond. Structure of protein: primary, secondary, tertiary and quaternary structure.

UNIT-IV: Chemistry of Lipids
Definition, classification and functions of lipids. Occurrence, chemistry and biological functions of simple lipids, compound lipids (e.g. phospholipids) and derived lipids: steroids (e.g. cholesterol). Physical property-emulsification. Chemical property-saponification. Functions of bile acids and bile salts.

UNIT-V: Chemistry of Nucleic acids
Definition - nucleoside, nucleotide and polynucleotide. Double helical model of DNA and its biological functions. Structure, types and functions of RNA: tRNA, mRNA and rRNA. Differences between DNA and RNA.
References:

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan
   worth Publishers.

   Medical Books. 25th edition.


4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.

5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.

5. MATHEMATICS – I*

Objectives of the Course:
To Explore the Fundamental Concepts of Mathematics

UNIT-I: ALGEBRA
Partial Fractions - Binomial, Exponential and logarithmic Series (without Proof) - Summation - Simple problems

UNIT-II : THEORY OF EQUATIONS
Polynomial Equations with real Coefficients - Irrational roots - Complex roots - Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations - Newton’s method to find a root approximately - Simple problems.

UNIT-III : MATRICES
Symmetric - Skew-Symmetric - Orthogonal and Unitary matrices - Eigen roots and eigen vectors – Cayley - Hamilton theorem (without proof)-Verification and computation of inverse matrix

UNIT-IV: TRIGONOMETRY
Expansions of $\sin^n \theta$, $\cos^n \theta$, $\sin\theta$, $\cos\theta$, $\tan\theta$ - Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of $\theta$.

UNIT-V: DIFFERENTIAL CALCULUS
Successive differentiation upto third order, Jacobians -Concepts of polar co-ordinates-Curvature and radius of curvature in Cartesian co-ordinates and in polar co-ordinates.

Recommended Text:

Reference Books:
SEMMESTER II
PAPER – 2
GENERAL CHEMISTRY - II

OBJECTIVES:
• Basic knowledge on s- and p- Block Elements, Group Study, Hydrocarbons, Cycloalkanes, Dienes, Quantum Chemistry, Thermochemistry, First Law of Thermodynamics, Derivation of Equations, Related Problems, Reaction Mechanism and Applications wherever necessary are to be taught for II- Semester.

UNIT-I s- and p- Block Elements
1.1 Alkali metals - Li, Na, K, Rb and Cs - Occurrence - Comparative study of Elements with respect to Oxides, Halides, Hydroxides and Carbonates - Exceptional property of Lithium - Diagonal Relationship of Li with Mg.

1.2 Alkaline earth metals - Be, Mg, Ca, Sr and Ba - Occurrence - Comparative study of the elements with respect to Oxides, Hydroxides, Halides, Sulphates and Carbonates - Exceptional property of Beryllium - Diagonal relationship of Be with Al - Comparison of Alkaline Earth Metals with Alkali Metals - Magnesium acting as bridge element between II A and II B groups - Magnesium resembles Zinc.

1.3 p- Block elements - Boron family - Group discussion - Anomalous behaviour of Boron - Diagonal Relationship between Boron and Silicon - Electron deficiency and Electron acceptor behaviour of Boron trihalides - Bonding in Diborane (Hydrogen-bridge structure) - Preparation, Properties, structure and Uses of Borazine - NaBH₄ - Preparation and Uses.

UNIT-II HYDROCARBONS
2.2 Alkenes - Properties of alkenes – Electrophilic and Free radical addition - Addition reactions of Alkenes with mechanism - Addition of Hydrogen, Halogens, Hydrogen Halide (Markownikoff’s rule) - Hydrogen bromide (Peroxide effect) - Sulphuric Acid, Water, BH₃, Ozonolysis, Hydroxylation with KMnO₄ - Allylic substitution by NBS.


UNIT-III DIENES AND CYCLOALKANES

3.1 Dienes – Classification - Conjugated, Isolated and Cumulative Dienes - Stability of Dienes - 1, 2- and 1, 4- Addition reactions of H₂ and HX with mechanisms – Synthesis of dienes – 1, 3 - Butadiene, Isoprene and Chloroprene - Diels-Alder reaction.

3.2 Cycloalkanes - Preparation using Wurtz's reaction, Dieckmann's ring closure and Reduction of aromatic hydrocarbons - Substitution and Ring opening reactions.

3.3 Stability of Alkanes, Alkenes and Cycloalkanes - Bayer's strain theory - Theory of Strainless rings.

UNIT-IV QUANTUM CHEMISTRY AND THERMOCHEMISTRY


4.2 Schrodinger wave equation (Without derivation) - Significance of wave functions ψ and ψ² - Shapes of s, p and d- orbitals.
4.3 Thermodynamics - Definition and Explanation of terms - System, Boundary, Surroundings - Homogeneous and Heterogeneous systems - Isolated system - Closed system - Open system - Intensive and Extensive properties - State of a system - Independent state variables - Dependent state variables - Thermodynamic functions - State and Path functions.

UNIT-V THERMODYNAMICS


5.2 First law of Thermodynamics - Statement and Equation – $C_p$ and $C_v$ Relationship - Calculation of $W$, $Q$, $\Delta E$ and $\Delta H$ for the Expansion of Ideal Gases under Reversible, Isothermal and Adiabatic Conditions.

5.3 Thermochemistry - Heat of a reaction - Exothermic and Endothermic reactions - Calculation of $\Delta H$ from $\Delta E$ and vice versa - Thermochemical equations - Bond dissociation energy - Calculation from thermochemical data - Variation of Heat of a reaction with temperature - Kirchoff’s Equation and Its significance.
CORE PRACTICAL
Paper – 1
VOLUMETRIC ANALYSIS

**Acidimetry**
1. Estimation of Borax - Standard Sodium Carbonate
2. Estimation of Sodium Hydroxide - Standard Sodium Carbonate

**Iodometry**
4. Estimation of Copper - Standard Copper Sulphate
5. Estimation of Potassium Dichromate - Standard Potassium Dichromate

**Complexometry**
6. Estimation of Magnesium using EDTA.
7. Estimation of Zinc using EDTA

**Dichrometry**

**Precipitation titration**

**Permanganometry**
10. Estimation of Ferrous Sulphate – Standard FAS.

- Students must write Short Procedure for the given estimation in Ten Minutes during the examination and submit the Paper for Evaluation.
1. PHYSICS II

UNIT – I: WAVE MECHANICS


UNIT – II: NUCLEAR PHYSICS


UNIT – III: ENERGY PHYSICS


UNIT – IV: CRYSTALLOGRAPHY

Crystallography: The crystal structure – Unit Cell –Bravais lattice- structures of simple cubic-BCC and FCC- co ordination number, packing factor calculation for the above structures –Hexogonal closed packed(HCP) structure -Miller indices – concept of Reciprocal Vectors.

UNIT – V: ELECTRONICS

Electronics: Transistor characteristics in common base and common emitter mode- Transistor single stage amplifier- Expression for input impedance, output impedance and current gain.

Digital Electronics : NAND and NOR as universal building blocks- De Morgan’s theorem –statement and proof- Fabrication of diodes and transistors using Monolithic technology– limitations.
**Books for Study & Reference**

2. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics – Prof. Dhanalakshmi and others.
10. Renewable & Sustainable energy sources – Agarwal.
3. ZOOLOGY II

Objective:
To study the principles of cell biology, genetics, developmental biology, physiology, ecology and evolution.

UNIT - I

UNIT - II
Embryology - cleavage and gastrulation of Amphioxus.

Human Physiology: Digestion, Circulation - blood components, structure of heart, heart function.

UNIT - III
Diseases of Circulatory system - blood pressure, heart disease - Ischemia, Myocardial Infarction, Rheumatic heart disease, stroke.

Excretion - structure of kidney and mechanism of urine formation.

UNIT - IV

UNIT - V
Evolution: Theories of Lamarkism & Darwinism.

REFERENCES:

4. BIOCHEMISTRY II

UNIT-I: Metabolism

Glycolysis, TCA cycle and its energetics, HMP shunt pathway. Deamination, transamination reaction, transaminase enzymes, Urea cycle.

UNIT-II: Metabolic Disorders

Diabetes mellitus, Glycogen storage diseases, Glycosuria, Ketosis, Jaundice, Phenyl ketonuria, Alkaptonuria. Dehydration: definition, causes, symptom and prevention.

UNIT-III: Enzymes


UNIT-IV: Molecular Biology


UNIT-V: Vitamins

A brief outline of source, requirement, biological function and deficiency of Vitamins (fat soluble and water soluble vitamins).

References:

4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
5. MATHEMATICS – II*

Objectives of the Course
To Explore the Fundamental Concepts of Mathematics

UNIT-I: Application of Integration
Evaluation of double, triple integrals - Simple applications to area, volume -Fourier series for functions in $(0,2\pi)$ and $(-\pi, \pi)$.

UNIT-II: Partial Differential Equations
Formation, complete integrals and general integrals - Four standard types, Lagrange’s equations.

UNIT-III: Laplace Transforms
Laplace Transformations of standard functions and simple properties - Inverse Laplace transforms - Applications to solutions of linear differential equations of order 1 and 2-simple problems

UNIT-IV: Vector Analysis
Scalar point functions - Vector point functions - Gradient, divergence, curl - Directional derivatives - Unit to normal to a surface.

UNIT-V: Vector Analysis (continued)
Line and surface integrals - Guass, Stoke’s and Green’s theorems (without proofs) - Simple problem based on these Theorems.

Recommended Text

Reference Books:
ALLIED PRACTICAL

1. PHYSICS

(Any 15 Experiments)

1. Young’s modulus – non uniform bending – pin and microscope.
5. Surface Tension and Interfacial Tension – By drop weight method.
7. Sonometer – Determining A.C. Frequency. (Screw Gauge is given).
8. Sonometer – frequency of tuning fork.
10. Air Wedge – Determination of thickness of thin wire.
16. Figure of merit and voltage sensitiveness of table galvanometer.
17. Construction of AND, OR gates using diodes and NOT by transistors.
19. NAND / NOR as universal gate.
20. Demorgan’s theorem verification.
3. ZOOLOGY

I - MAJOR PRACTICAL

DISSECTIONS

Cockroach: Digestive and nervous system

Prawn: Nervous system

II - MINOR PRACTICAL

MOUNTING

1. Mouth parts of Mosquito and Honey bee

2. Earthworm - Body setae

3. Placoid scales of shark

III - SPOTTERS

Entamoeba, Sycon, Obelia, Taenia solium (entire, scolex) earthworm (entire, Pineal setae) Prawn (entire), Fresh water mussel, Sea star, Amphioxus - Entire, Amphioxus - T.S. through pharynx, Shark, Frog, Calotes, Pigeon, feathers of pigeon and Rabbit.

Sphygmanometer, Stethoscope, Rain gauge.

REFERENCES:


ALLIED PRACTICAL

4. BIOCHEMISTRY I & II

PRACTICAL I

Volumetric Estimation

1. Estimation of HCl using Na2CO3 as link and NaOH as primary standard.

2. Estimation of Iron in Ferrous Ammonium Sulphate using potassium permanganate as link solution and oxalic acid as primary standard.

3. Estimation of Glucose by Benedict’s method.

4. Estimation of Glycine by formal titration.

5. Estimation of Ascorbic acid.
OBJECTIVE:

Basic concepts regarding the Principles of Inorganic Analysis and Applications of Qualitative Analysis, Types of Solvents, p- Block Elements, Group Study, Aromaticity, Electrophilic and Nucleophilic Substitution Reactions, Elimination Reactions, Reaction Mechanism, Second Law of Thermodynamics, Derivation of Equations, Related Problems and Applications wherever necessary are to be taught for III semester.

UNIT-I

1.1 Semimicro Techniques - Principles of Acid-Base Equilibria - Common ion effect - Solubility Product and its Applications in Qualitative Analysis - Principles of Inorganic Analysis.

1.2 Reactions involved in the Separation and Identification of Cations and Anions in Qualitative analysis - Spot test reagents - Aluminon, Cupferon, DMG, Thiourea, Magneson, Alizarin and Nessler's reagent.

1.3 Types of solvents - Protic and Aprotic solvents - Amphiprotic / Amphoteric solvents - Aqueous and Non-aqueous solvents - Liquid Ammonia as a solvent.

UNIT-II

2.2 Nitrogen family - Group study - Comparative study of N, P, As, Sb and Bi with respect to Oxides, Oxyacids, Halides and Hydrides – Hydrazine and Hydroxylamine - Preparation, Properties, Structure and Uses.

2.3 Oxygen family - Group study - Comparative study of O, S, Se and Te with respect to Catenation, Oxides, Halides, Hydrides and Oxyacids - Anomalous Behaviour of Oxygen - Oxyacids of Sulphur (Structure only) - Peracids of Sulphur - Preparation, Properties and Structure - Differences Between Permonosulphuric Acid and Perdisulphuric Acid.

UNIT-III

3.1 Aromaticity - Modern Theory of Aromaticity - Huckel’s (4n +2) Rule and Its Simple Applications to Benzenoid and Non-benzenoid Compounds.

3.2 Electrophilic substitution reactions in Aromatic Compounds - Mechanisms of Nitration, Halogenations, Sulphonation, Friedel-Crafts Acylation and Alkylation.

3.3 Directive influence - Orientation - Ortho/Para ratio - Nuclear and Side chain Halogenation.

UNIT-IV

4.1 Aliphatic Nucleophilic Substitutions - Mechanisms of $S_N1$, $S_N2$ and $S_{Ni}$ Reactions – Effect of Structure of Substrate, Solvent, Nucleophile and Leaving Group.

4.2 Elimination reactions - Mechanism of E1 and E2 reactions - Hoffmann and Saytzeff”s rules - Cis and Trans Eliminations.

4.3 Aromatic Nucleophilic Substitutions - Unimolecular Nucleophilic Substitution, Bimolecular Nucleophilic Substitution and their Mechanism.
UNIT-V


5.2 Carnot's cycle - Efficiency - Carnot's theorem (Statement only) - Concept of Entropy - Definition and Mathematical Statement - Randomness and Entropy – Standard Entropy - Derivation of Entropy from Carnot Cycle.

UNIT – I: PROPERTIES OF MATTER


Surface Tension: Surface Tension – Surface Tension and interfacial surface tension by the method of drops.

UNIT – II: HEAT


UNIT – III: ELECTRICITY AND MAGNETISM


UNIT – IV: SOUND AND ACOUSTICS OF BUILDING


Ultrasonics – Production by Piezo – electric method – properties and uses.

Acoustics of buildings: Reverberation – Reverberation time – Sabine’s formula (definition only) – Sound absorption co-efficient of surface – conditions for the perfect acoustics.
UNIT – V: OPTICS

Interference: Air Wedge – Description – Test for optical flatness of glass plate – Determination of diameter of a thin wire by air wedge.


Fibre optics: principle-classification of optical fibres-fibre optic communication system block diagram.

Books for Study & Reference

10. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
11. Allied Physics – Prof. Dhanalakshmi and others.
ALLIED

3. ZOOLOGY I

Objective:

To acquire knowledge about different kinds of animal species.

To study the systematic and functional morphology of invertebrates and chordates.

UNIT – I:
Type study includes life history.


UNIT - II
Annelida - Earthworm, Arthropoda - Prawn, Mollusca - Fresh water mussel, Echinodermata - Sea star.

UNIT – III:
Type study includes morphology, digestive system, respiratory system, circulatory system and urinogenital system of Chordate.


UNIT - IV
Amphibia: Frog, Reptiles: Calotes

UNIT - V
Aves: Pigeon, Mammalia: Rabbit.

REFERENCES:


4. BIOCHEMISTRY I

UNIT-I: Chemistry of Carbohydrates

Definition and Classification of carbohydrate. Monosaccharides - occurrence, structure; physical and chemical properties, linear and ring forms (Haworth formula) for glucose and fructose. Disaccharides - occurrence, structure; physical and chemical properties of sucrose and lactose. Polysaccharides - occurrence, structure, physical and chemical properties of starch.

UNIT-II: Chemistry of amino acids

Definition and classification of amino acids. Reaction with ninhydrin, common properties of amino acids, amphoteric nature, isoelectric point, isoelectric pH and Zwitter ion.

UNIT-III: Chemistry of Proteins

Classification based on solubility, shape and size. Physical properties: salting in and salting out, denaturation, peptide bond. Structure of protein: primary, secondary, tertiary and quaternary structure.

UNIT-IV: Chemistry of Lipids

Definition, classification and functions of lipids. Occurrence, chemistry and biological functions of simple lipids, compound lipids (e.g. phospholipids) and derived lipids: steroids (e.g. cholesterol). Physical property-emulsification. Chemical property-saponification. Functions of bile acids and bile salts.

UNIT-V: Chemistry of Nucleic acids

Definition - nucleoside, nucleotide and polynucleotide. Double helical model of DNA and its biological functions. Structure, types and functions of RNA: tRNA, mRNA and rRNA. Differences between DNA and RNA.
References:


4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.

5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.

5. MATHEMATICS – I*

Objectives of the Course:
To Explore the Fundamental Concepts of Mathematics

UNIT-I: ALGEBRA
Partial Fractions - Binomial, Exponential and logarithmic Series (without Proof) - Summation - Simple problems

UNIT-II: THEORY OF EQUATIONS
Polynomial Equations with real Coefficients - Irrational roots - Complex roots- Transformation of equation by increasing or decreasing roots by a constant - Reciprocal equations - Newton’s method to find a root approximately - Simple problems.

UNIT-III: MATRICES
Symmetric - Skew-Symmetric - Orthogonal and Unitary matrices - Eigen roots and eigen vectors – Cayley - Hamilton theorem (without proof)-Verification and computation of inverse matrix

UNIT-IV: TRIGONOMETRY
Expansions of \( \sin^n \theta, \cos^n \theta, \sin \theta, \cos \theta, \tan \theta \) - Expansions of \( \sin \theta, \cos \theta, \tan \theta \) in terms of \( \theta \).

UNIT-V: DIFFERENTIAL CALCULUS
Successive differentiation upto third order, Jacobians -Concepts of polar co-ordinates-Curvature and radius of curvature in Cartesian co-ordinates and in polar co-ordinates.

Recommended Text:

Reference Books:
Objective:

- To impart knowledge about the various methods of Water Analysis and Treatment of Water.

UNIT-I

1.1 Introduction - Characteristics of water - Alkalinity - Hardness - Unit of hardness – Total solids - Oxidation - Transparency - Silica content.

1.2 Purification of Water for drinking purpose - Potability of water – Clarification - Coagulation - Contact and Electrochemical Coagulation.

1.3 Sterilisation and Disinfection of water - Precipitation - Aeration - Ozonisation - Chlorination.

UNIT-II

2.1 Water Softening Methods - Clark’s process - Lime soda process - Modified lime soda process - Permutit or Zeolite process - Ion exchange process - Demineralisation of water.

2.2 Determination of Hardness of water - Titration method - Complexometric method using EDTA - Expressing Hardness.

2.3 Equivalents of Calcium Carbonate - Problems to determine Temporary and Permanent Hardness.
UNIT-III

3.1 Hard water and Industries - Industrial water treatment - Boiler feed water method of Softening - Prevention of plumbo solvency - Scales in boilers - Consequences - Internal conditioning methods.

3.2 Desalination of Brackish water - Elecrodiaysis - Reverse osmosis - Removal of Fe, Mn and Silicic acid.

3.3 Effluent Treatment of Water from Paper Industry, Petrochemicals, Fertilizer industry and Power station.

UNIT-IV


4.2 Analysis of Solids present in water - Suspended Solids - Dissolved Solids - Total Acidity - Alkalinity - Free CO$_2$ - Free Chlorine - Ca, Mg, Fe, Mn, Ag and Zn.

4.3 Water in Industry – Pollution of Water by Fertilisers, Detergents, Pesticides and Industrial wastes.

UNIT-V

5.1 Analysis of Chemical Substances Affecting Health - NH$_3$, Nitrate, Nitrite, Cyanide, Sulphate, Sulphide, Chloride and Fluoride.

5.2 Measurement of Toxic Chemical Substances - Analysis of Chemical Substances indicative of Pollution - Dissolved oxygen - Biochemical Oxygen Demand (BOD) - Chemical Oxygen Demand (COD)
5.3 Bacteriological Examination of Water - Total Count Test - E. coli test - E. coli index - Most Probable Number method - Biological Examination of Water - Physical Examination of Water - Radioactivity of Water - Methods of removing Radioactivity from Water.

Reference Books

NON-MAJOR ELECTIVE

PAPER – 1

MEDICINAL CHEMISTRY

Objectives:

• To learn the basic idea of Drugs and Names of Common Drugs, Blood, Blood Pressure, Diabetes, AIDS, Vitamins, Indian Medicinal Plants and First Aid.

UNIT-I

1.1 Clinical Health and Biochemical Analysis - Definition of Health - WHO standard.

1.2 Sterilisation of Surgical Instruments - Biochemical Analysis of Urine and Serum.

1.3 Blood – Composition of Blood - Blood grouping and Rh factor.

UNIT-II

2.1 Common Drugs - Antibiotics, Antipyretics and Analgesics - Examples, Uses and Side effects.

2.2 Anti-inflammatory agents, Sedatives, Antiseptics and Antihistamines - Examples, Uses and Side effects.

2.3 Tranquilizers, Hypnotics and Antidepressant drugs - Definition, Examples, Uses and Side effects.

UNIT-III

3.1 Vital Ailments and Treatment - Blood pressure - Hypertension and Hypotension.

3.2 Diabetes, Cancer, AIDS - Causes, Symptoms and Treatment.

3.3 Vitamins – Classification of Vitamins – Sources and Deficiency diseases caused by Vitamins.
UNIT-IV

4.1 Indian Medicinal Plants - Palak, Vallarai, Kizhanelli and Thumbai - Chemical Constituents and Medicinal Uses.
4.2 Hibiscus, Adadodai, Thoothuvalai – Chemical Constituents and Medicinal Uses.
4.3 Nochi, Thulasi, Aloe Vera - Chemical Constituents and Medicinal Uses.

UNIT- V

5.1 First Aid and Safety - Treatment of Shock, Haemorrage, Cuts and Wounds.
5.2 Burns - Classification - First Aid.

Reference Books

SEMESTER – IV

PAPER – 4

GENERAL CHEMISTRY – IV

OBJECTIVE:

Noble gases, Carboxylic Acids, Amines, Alcohols, Phenols, Naphthols, Important Name Reactions, Mechanism, Thermodynamics, Derivation of Equations, Partial Molar Properties, Chemical Potential, Related Problems and Applications are to be taught for IV semester.

UNIT-I

1.1 Noble gases - Electronic Configurations – Position of Noble Gases in the Periodic Table - Chemical inertness of Noble gases – Reason.

1.2 Compounds of Xenon - Hybridization and Geometry of XeF₂, XeF₄, XeF₆ and XeOF₄ (Preparation, Properties – Not necessary).

1.3 Clathrates - Definition and Applications - Uses of Noble gases.

UNIT-II


2.2 Dicarboxylic acids – Oxalic acid, Malonic acid, Succinic acid, Glutaric acid and Adipic acid - Preparation – Properties – Action of Heat on Dicarboxylic acids.

UNIT-III


3.3 Preparation, Properties and Uses of Alpha- and Beta- Naphthols.

UNIT-IV

4.1 Free energy and Work function - Gibbs free energy – Helmholtz free energy – Relationship between Gibbs free energy and Helmholtz free energy – Their variations with Temperature, Pressure and Volume – Free energy change as criteria for Equilibrium and Spontaneity.

4.2 Maxwell’s Relations – Thermodynamic Equation of State.

4.3 Gibbs-Helmholtz equation - Derivation and Applications - Clausius-Clapeyron equation - Derivation and Applications.
UNIT-V


5.2 Evaluation of Absolute Entropy from Heat Capacity Measurements - Exceptions to III law – Applications of III law.

5.3 Partial molar properties - Chemical Potential – Definition - Effect of Temperature and Pressure on Chemical Potential - Gibbs-Duhem equation.
CORE PRACTICAL

PAPER – 2

INORGANIC QUALITATIVE ANALYSIS AND PREPARATION

Analysis of mixture containing two cations and two anions (One will be an interfering anion). Semimicro methods using the conventional scheme are to be adopted.

Cations to be studied
Lead, Copper, Bismuth, Cadmium, Iron, Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

Anions to be studied
Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate.

Preparation of Inorganic compounds

- Tetraamminecopper(II) Sulphate
- Tris(thiourea)copper(I) Chloride
- Potassium trioxalatoferrate(II)
- Ferrous Ammonium Sulphate
- Microcosmic Salt
- Manganese(II) Sulphate

References

- Inorganic Semimicro Qualitative Analysis, V. V. Ramanujam.
UNIT – I: WAVE MECHANICS


UNIT – II : NUCLEAR PHYSICS


UNIT – III : ENERGY PHYSICS


UNIT – IV: CRYSTALLOGRAPHY

Crystallography : The crystal structure – Unit Cell –Bravais lattice- structures of simple cubic-BCC and FCC- co ordination number, packing factor calculation for the above structures –Hexogonal closed packed(HCP) structure -Miller indices – concept of Reciprocal Vectors.

UNIT – V: ELECTRONICS

Electronics: Transistor characteristics in common base and common emitter mode- Transistor single stage amplifier- Expression for input impedence, output impedence and current gain.

Digital Electronics : NAND and NOR as universal building blocks- De Morgan’s theorem –statement and proof- Fabrication of diodes and transistors using Monolithic technology– limitations.
Books for Study & Reference

13. Allied Physics – Prof. Dhanalakshmi and others.
20. Renewable & Sustainable energy sources – Agarwal.
3. ZOOLOGY II

Objective:
To study the principles of cell biology, genetics, developmental biology, physiology, ecology and evolution.

UNIT - I

UNIT - II
Embryology - cleavage and gastrulation of Amphioxus.

Human Physiology: Digestion, Circulation - blood components, structure of heart, heart function.

UNIT - III
Diseases of Circulatory system - blood pressure, heart disease - Ischemia, Myocardial Infarction, Rheumatic heart disease, stroke.

Excretion - structure of kidney and mechanism of urine formation.

UNIT - IV

UNIT - V
Evolution: Theories of Lamarkism & Darwinism.

REFERENCES:

4. BIOCHEMISTRY II

UNIT-I: Metabolism

Glycolysis, TCA cycle and its energetics, HMP shunt pathway. Deamination, transamination reaction, transaminase enzymes, Urea cycle.

UNIT-II: Metabolic Disorders

Diabetes mellitus, Glycogen storage diseases, Glycosuria, Ketosis, Jaundice, Phenylketonuria, Alkaptonuria. Dehydration: definition, causes, symptom and prevention.

UNIT-III: Enzymes


UNIT-IV: Molecular Biology


UNIT-V: Vitamins

A brief outline of source, requirement, biological function and deficiency of Vitamins (fat soluble and water soluble vitamins).

References:

4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
5. MATHEMATICS – II*

Objectives of the Course
To Explore the Fundamental Concepts of Mathematics

UNIT-I: Application of Integration
Evaluation of double, triple integrals - Simple applications to area, volume - Fourier series for functions in (0,2π) and (−π, π).

UNIT-II: Partial Differential Equations
Formation, complete integrals and general integrals - Four standard types, Lagrange’s equations.

UNIT-III: Laplace Transforms
Laplace Transformations of standard functions and simple properties - Inverse Laplace transforms - Applications to solutions of linear differential equations of order 1 and 2-simple problems

UNIT-IV: Vector Analysis
Scalar point functions - Vector point functions - Gradient, divergence, curl - Directional derivatives - Unit to normal to a surface.

UNIT-V: Vector Analysis (continued)
Line and surface integrals - Guass, Stoke’s and Green’s theorems (without proofs) - Simple problem based on these Theorems.

Recommended Text

Reference Books:
25. Surface Tension and Interfacial Tension – By drop weight method.
27. Sonometer – Determining A.C. Frequency. (Screw Gauge is given).
33. Potentiometer – Calibration of High Range Ammeter.
34. Potentiometer – Calibration of Low Range Voltmeter.
35. Determination of M and B\(_H\) using Deflection Magnetometer in Tan C position and vibration magnetometer.
36. Figure of merit and voltage sensitiveness of table galvanometer.
37. Construction of AND, OR gates using diodes and NOT by transistors.
38. Zener diode – Voltage Regulation.
39. NAND / NOR as universal gate.
40. Demorgan’s theorem verification.
I - MAJOR PRACTICAL

DISSECTIONS

Cockroach: Digestive and nervous system

Prawn: Nervous system

II - MINOR PRACTICAL

MOUNTING

1. Mouth parts of Mosquito and Honey bee

2. Earthworm - Body setae

3. Placoid scales of shark

III - SPOTTERS

Entamoeba, Sycon, Obelia, Taenia solium (entire, scolex) earthworm (entire, Pineal setae) Prawn (entire), Fresh water mussel, Sea star, Amphioxus - Entire, Amphioxus - T.S. through pharynx, Shark, Frog, Calotes, Pigeon, feathers of pigeon and Rabbit.

Sphygomanometer, Stethoscope, Rain gauge.

REFERENCES:


ALLIED PRACTICAL

4. BIOCHEMISTRY I & II

PRACTICAL I

Volumetric Estimation

1. Estimation of HCl using Na2CO3 as link and NaOH as primary standard.

2. Estimation of Iron in Ferrous Ammonium Sulphate using potassium permanganate as link solution and oxalic acid as primary standard.

3. Estimation of Glucose by Benedict’s method.

4. Estimation of Glycine by formal titration.

5. Estimation of Ascorbic acid.
SKILL BASED SUBJECT

PAPER – 2

FOOD CHEMISTRY

Objective:

- To impart knowledge about Different Foods, Their Nutritive Values and Food Preservation.

UNIT-I

1.1 Cereals - Definition – Classification - Processing - Structure of Cereals - Composition and Nutritive value – Pulses - Definition - Classification - Processing - Structure of Pulses - Composition and Nutritive Value - Toxic Constituents in Pulses - Medicinal value of Cereals and Pulses.

1.2 Sugar - Structure and Properties - Nutritive value - Sugar composition in different food items.

1.3 Sugar related products - Classification and Nutritive value - Artificial sweeteners – Examples – Saccharin and Cyclamate - Advantages and Disadvantages.

UNIT-II

2.1 Vegetables and Fruits - Classification - Composition and Nutritive values.

2.2 Fungi and Algae as food - Enzymatic Browning and Non- enzymatic Browning.

2.3 Nutritive value of some common foods - Milk, Egg and Soyabeans.

UNIT-III

3.1 Beverages - Definition - Examples – Classification.

3.2 Fruit Beverages - Milk Based Beverages - Malted Beverages - Examples – Alcoholic and Non-Alcoholic Beverages – Examples.

3.3 Appetizers - Definition - Classification - Examples - Water - Functions and Deficiency.
UNIT-IV

4.1 Food Preservatives - Definition - Classification - Food Spoilage - Definition - Prevention.
4.2 Methods of Preservation - Classification - Low and High temperature – Preservatives – Examples.
4.3 Dehydration - Osmotic pressure - Food irradiation.

UNIT-V

5.1 Food Additives - Definition – Artificial sweeteners – Saccharin and Cyclamate - Classification - Their functions - Chemical substances.
5.2 Packaging of Foods – Classification - Materials used for Packaging.

Reference Books

- Food Science, Nutrition and Health – Brian A. Fox, Allan G. Cameron, Edward Arnold, London.
Objectives:

• To know the basics of Chemistry in our life

• To know about the Food Colours, Plastics, Drugs etc.,

UNIT- I

1.1 General Survey of Chemicals used in everyday life.

1.2 Cosmetics - Talcum Powder, Tooth pastes, Shampoos, Nail Polish and Perfumes - General formulation - Preparation - Hazards of Cosmetic use.

1.3 Soaps and Detergents – Types - Preparation and Uses.

UNIT-II

2.1 Food and Nutrition - Carbohydrates, Proteins, Fats and Minerals – Examples.

2.2 Vitamins – Definitions – Classification - Sources and their Physiological importance - Balanced diet.

2.3 Adulterants in Milk, Ghee, Oil, Coffee Powder, Tea, Asafoetida, Chilli Powder, Pulses and Turmeric Powder - Identification.

UNIT-III

3.1 Food colours used in food - Soft drinks and its Health hazards.

3.2 Food Preservatives – Definition – Examples - Methods of preservation - Low and High temperature.

3.3 Dehydration - Osmotic pressure - Food irradiation.
UNIT-IV

4.1 Plastics, Polythene, PVC, Bakelite, Polyesters, Resins and their Applications.

4.2 Natural Rubber - Synthetic rubbers - Vulcanisation - Preparation and its Applications.

4.3 Antipyretics, Analgesics, Anaesthetics, Sedatives – Definition - Examples and Uses.

UNIT-V

5.1 Gobar gas – Production – Feasibility and Importance of Biogas with special reference to Rural India.

5.2 Fertilizers – Definition – Classification - Urea, NPK and Super phosphates - Need - Uses and Hazards.

5.3 Sweetening agents – Sucrose and Glucose – Artificial Sweetening agents – Saccharin – Cyclamate – Advantages and Disadvantages.

Reference Books


2. Perfumes, Cosmetics and Soaps - W. A. Poucher (Vol 3).


Objectives:

- To study about the Halogens and Related compounds.
- To give students a firm grounding in Co-ordination chemistry and Solid state Chemistry.

UNIT-I

1.1 Halogens – Group discussion - Comparative study of F, Cl, Br, I and At - Reactivities – Comparison of Fluorine with Oxygen.
1.2 Classification of Halides - Exceptional properties of Fluorine - Oxyacids of Halogens (Structure only).
1.3 Interhalogen compounds - Preparation, Properties and Geometry of AX, AX₃, AX₅ and AX₇ type of Compounds – Pseudohalogens - Cyanogen and Thiocyanogen – Comparison of Pseudohalogens and Halogens - Basic Properties of Iodine - Evidences.

UNIT-II

2.1 Coordination compounds - Definition of terms used - Classification of Ligands - Chelation and Effect of Chelation - Applications of Complexes - Coordination Number and Stereochemistry of Complexes.
2.2 IUPAC Nomenclature of Complexes - Isomerism in Complexes - Ionisation isomerism, Hydrate Isomerism, Linkage Iomerism, Ligand Isomerism, Coordination Isomerism and Polymerisation Isomerism.
2.3 Geometrical and Optical Isomerism in 4- and 6- Coordinated Complexes – Werner’s theory of Coordination Compounds.
UNIT-III

3.1 Sidgwick’s Theory - EAN rule - Theory of Bonding - Valence Bond Theory – Postulates of VBT – Hybridisation, Geometry and Magnetic properties - Failure of VBT.
3.2 Crystal field theory - Spectrochemical series - Splitting of d - orbitals in Octahedral, Tetrahedral and Square Planar Complexes - Crystal Field Stabilisation Energy - Calculation of CFSE In Octahedral and Tetrahedral Complexes.
3.3 Low Spin and High Spin Complexes – Explanation of Magnetic Properties, Colour and Geometry Using CFT.

UNIT-IV

4.1 Comparison of VBT and CFT.
4.2 Applications of Coordination Compounds in Qualitative and Quantitative Analysis - Estimation of Nickel using DMG and Aluminium using Oxine – Detection of Potassium ion – Separation of Copper and Cadmium ions.
4.3 Bonding, Hybridization and Structure of Carbonyls of Ni, Cr, Fe, Co, Mn, W and V.

UNIT-V

5.1 The nature of the Solid State – Amorphous and Crystalline – Differences - Close Packing in Crystals – Examples for Cubic, BCC and FCC Lattices - Bragg’s law – Application of XRD to Crystal studies – Structure of NaCl, CsCl, CaF$_2$ and ZnS.
5.2 Band theory of Solids, Metals, Semiconductors and Insulators.
5.3 Defects in solids – Scottky Defect and Frenkel Defect – Metal Excess and Metal Deficiency Defects - Conductors in Ionic Solids – Electrical and Magnetic properties.
Objectives:

- To effectively impart knowledge about Carbohydrates, Stereochemistry, Conformational Analysis, Nitroalkanes and Heterocyclic chemistry.
- To make the students more inquisitive in learning the Mechanistic details in Organic Chemistry through the teaching of the named reactions.

UNIT- I


1.2 Determination of Ring Size- Haworth Projection Formula - Configuration of Glucose and Fructose - Epimerization - Chain lengthening and chain shortening of Aldoses - Inter conversion of Aldoses and Ketoses – Uses of Glucose.

1.3 Disaccharides and Polysaccharides - Reactions and Structural elucidation of Sucrose and Maltose - Properties, Structure and Uses of Starch and Cellulose.

UNIT- II

2.1 Stereoisomerism – Definition - Classification into Optical and Geometrical isomerism. Conditions for Optical Activity – Asymmetric centre – Chirality – Achiral molecules - Meaning of (+) and (-) and D- and L- notations – Elements of symmetry - Projection formulae - Fischer, Flying Wedge, Sawhorse and Newmann projection formulae - Notation

2.2 Optical activities in Compounds not containing Asymmetric Carbon Atoms - Biphenyl, Allenes and Spiranes - Racemisation - Methods of Racemisation (By substitution and Tautomerism) – Resolution - Methods of Resolution (Mechanical, Biochemical and Conversion To Diastereomers) - Asymmetric Synthesis (Partial and Absolute Synthesis) - Walden inversion.


UNIT- III

3.1 Conformational analysis - Introduction of terms - Conformations, Configuration, Dihedral Angle, Torsional Strain - Differences between Conformational isomers and Configurational isomers.

3.2 Conformational analysis of Ethane and n-Butane including energy diagrams.

3.3 Conformations of Cyclohexane (Chair, Boat and Twist-Boat forms) - Axial and Equatorial bonds - Ring flipping showing Axial and Equatorial bonds Interconversions – Conformations of Methyl Cyclohexane, Dimethyl Cyclohexane and their stability - 1,2 and 1,3 - Interactions.
UNIT- IV


4.2 Reagents and their Applications in Organic Chemistry – Anhydrous AlCl₃, P₂O₅, H₂/Pd- BaSO₄, Zn/ Hg- HCl and Ag₂O.

4.3 Mechanism of Aldol, Perkin and Benzoin condensations - Knoevenagel, Claisen, Wittig, Cannizzaro, Reformatsky and Michael addition reactions.

UNIT- V

5.1 Heterocyclic compounds - Huckel’s rule – Aromaticity of Heterocyclic compounds - Preparation, Properties, Structure and Uses of Furan, Pyrrole and Thiophene.

5.2 Preparation and properties of Pyridine and Piperidine - Comparative study of Basicity of Pyrrole, Pyridine and Piperidine with Amines – Nucleophilic and Electrophilic substitution reactions of Pyridine.

5.3 Condensed Five and Six Membered Heterocyclic Compounds - Preparation of Indole, Quinoline and Isoquinoline – Fischer-Indole synthesis, Skraup Quinoline synthesis and Bischler-Napieralski synthesis - Electrophilic substitution reactions.
PAPER- 7
PHYSICAL CHEMISTRY – I

Credits: 4

Hours/ Week: 4

Objectives:

- To impart knowledge about the Solutions, Phase Rule and its Applications, Colligative properties, Chemical Equilibrium, Phase Rule and its Applications, Electrochemistry and its Applications.

Unit-I Solutions


1.3 Nernst distribution law – Definition - Thermodynamic derivation – Applications.

Unit-II Phase rule

2.1 Definition of the terms - Phase, Components and Degrees of freedom – Derivation of Gibbs phase rule

2.2 Applications of phase rule - One component system - Water and Sulphur system – Reduced phase rule - Two components system - Simple eutectic system – Lead-silver system, KI-water system - Freezing mixtures.

2.3 Thermal analysis and cooling curves, Compound formation with congruent melting point – Zn-Mg, FeCl₃- Water system - Compound formation with incongruent melting point - Na-K System.
Unit-III Colligative properties and Chemical Equilibrium

3.1 Colligative properties - Lowering of vapour pressure - Osmosis and osmotic pressure - Thermodynamic Derivation of Elevation of boiling point and Depression of freezing point – Determination of molar mass – Van’t Hoff factor.
3.3 Van’t Hoff Reaction Isotherm - Temperature Dependence of Equilibrium Constant – Van’t Hoff Isochore - Le Chatelier’s Principle and Its Applications.

UNIT-IV Electrochemistry - I

4.1 Specific conductance and Equivalent conductance - Measurement of equivalent conductance - Variation of Equivalent Conductance and Specific Conductance with Dilution – Ostwald’s Dilution Law and Its Limitations.
4.2 Debye-Huckel’s theory of Strong Electrolytes - Onsagar equation (No derivation) - Verification and Limitations - Kohlrausch law and its Applications.
4.3 Migration of ions - Ionic Mobility - Ionic Conductance - Transport Number and its determination – Hittorff’s method and Moving Boundary method.

UNIT-V Electrochemistry - II

5.1 Applications of Conductometric Measurements - Determination of Degree of Dissociation of Weak Electrolytes, Ionic Product of water - Solubility Product of sparingly soluble salt - Conductometric Titrations.
5.2 Concept of pH - Buffer solutions, Buffer action - Henderson equation - Applications of Buffer Solutions.
5.3 Hydrolysis of Salts - Expressions for Hydrolysis Constant, Degree of Hydrolysis and pH of aqueous salt solutions.
ELECTIVE
PAPER – 1

A. ANALYTICAL CHEMISTRY – 1

Objective:
- To impart knowledge about Data Analysis, Purification of organic compounds, Different Spectroscopic Techniques and their Application.

UNIT – I

1.1. Data analysis – Types of errors – Correction of determinate errors - Idea of Significant Figures and their Importance with examples – Precision and Accuracy – Methods of expressing Accuracy.
1.2. Error analysis – Minimising errors – Methods of expressing Precision – Average deviation – Standard Deviation and Confidence Limit.

UNIT – II


2.3 Definition of spectrum – Electromagnetic radiation – Quantization of different forms of energies in molecules (Translational, Rotational, Vibrational and Electronic) – Born-Oppenheimer approximation – Condition of energy of absorption of various types of spectra.
UNIT – III


3.3 Types of Electronic Transitions – Chromophore and Auxochromes – Absorption bands and Intensity – Factors influencing Position and Intensity of Absorption Bands - Frank-Condon Principle – Applications.

UNIT – IV


4.2 Expression for Vibrational Frequency (Derivation not needed) – Calculation of Force constant – Factors influencing Vibrational Frequencies - IR Spectrophotometer - Instrumentation – Source, Monochromator, Cell, Detectors, Recorders and Sampling Techniques.


UNIT – V

5.1 Raman Spectroscopy - Rayleigh and Raman scattering – Selection rule – Raman shift - Stokes and Anti-stokes lines - Differences between Raman and IR Spectroscopy.

5.3 Rotational-Raman spectra of Non - Centrosymmetric molecules - Mutual exclusion principle (CO₂ and N₂O) - Applications – Structural diagnosis.

Reference Books

- Analytical Chemistry – R. Gopalan, Sultan Chand.
- Analytical Chemistry – S. Usharani, Macmillan.
Objective:

- To introduce the basics of computers.
- To learn C language and its applications in solving problems in Chemistry.

Unit-I

1.1 Basic Computer Organisation, Processor and Memory – Main Memory, Secondary Storage Devices and Storage Hierarchy.
1.2 Software – Relationship between Hardware and Software – Types of Software.

Unit-II

2.2 C language – Introduction - C Compiler - Operating Systems and Preprocessor Directives.
2.3 Variables, Constants, Operators, Input and Output Functions.

Unit-III

Control Structures – Conditional, Looping, Goto, Break, Switch and Continue Statements, Functions, Arrays And Pointers.
Unit-IV

4.1 Applications in Chemistry – Calculation of the Radius of the first Bohr orbit for an Electron.
4.2 Calculation of Half-life Time for an integral order reaction - Calculation of Molarity, Molality and Normality of a solution.
4.3 Calculation of Pressure of Ideal Gases and Van der Waal’s gases - Calculation of Electronegativity of an Element using Pauling’s relation.

Unit-V

5.1 Applications in Chemistry - Calculation of Empirical Formulae of Hydrocarbons - Calculation of Reduced Mass of a few Diatomic Molecules.
5.2 Determination of the Wave Numbers of Spectral lines of Hydrogen atom - Calculation of Work of Expansion in Adiabatic Process.
5.3 Calculation of pH, Solubility Product and Bond Energy using Born-Lande equation - Calculation of Standard Deviation and Correlation Coefficient.

Reference Books

C. ORGANIC SYNTHESIS

Objectives

- To know the Basics of Retrosynthesis.
- To impart knowledge about the Ring Synthesis.

UNIT-I

DISCONNECTION APPROACH

1.1 An introduction to Synthons and Synthetic Equivalent.

1.2 Disconnection Approach - Functional Group Interconversions.

1.3 The importance of the Order of Events in Organic Synthesis - One group C-X and Two group C-X disconnections – Chemoselectivity - Reversal of Polarity.

UNIT-II

PROTECTING GROUPS

2.1 Principle of Protection of Alcoholic group and Amino group.

2.2 Principle of Protection of Carbonyl group and Carboxyl group.

2.3 Activation of Functional Groups.

UNIT-III

ONE GROUP C-C DISCONNECTIONS

3.1 Alcohols and Carbonyl Compounds.

3.2 Regioselectivity and Alkene Synthesis.

3.3 Uses of Acetylenes and Aliphatic Nitro Compounds in Organic Synthesis.
UNIT-IV

TWO GROUP C-C DISCONNECTIONS

4.1 Diels-Alder Reaction - 1, 3 - Difunctionalised Compounds.

4.2 α, β- Unsaturated Carbonyl Compounds - Control in Carbonyl Condensations.

4.3 1, 5 - Difunctionalised Compounds - Michael Addition and Robinson Annulation reactions.

UNIT-V

RING SYNTHESIS

5.1 Saturated Heterocyclic Compounds.

5.2 Synthesis of 3-, 4- and 6- Membered Rings Aromatic Heterocycles in Organic Synthesis.

5.3 Application of the above in the Synthesis of Camphor, Longifoline, Cortisone and Reserpine.

Reference Books


- Modern Synthetic Reactions. H. O. House and W. A. Benjamin,
ELECTIVE
PAPER – 2

A. PHARMACEUTICAL CHEMISTRY

Objective:

* To effectively impart knowledge about Various Diseases and Their Treatment, Importance of Indian Medicinal Plants and Different Types of Drugs. Preparation, Synthesis and Structural Determination are not required for the Compounds mentioned.

UNIT-I
1.1 Definition of the following terms - Drug, Pharmacophore, Pharmacology, Pharmacopoeia, Bacteria, Virus, Chemotherapy and Vaccine.

1.2 Causes, Symptoms and Treatment for Jaundice, Cholera, Malaria and Filaria - First Aid for Accidents - Antidotes for Poisoning.

1.3 Organic Pharmaceutical Aids - Their Role as Preservatives, Antioxidants, Colouring, Flavouring and Sweetening agents – Examples.

UNIT-II
2.1 Causes, Detection and Control of Anaemia and Diabetes - Diagnostic tests for Sugar, Salt and Cholesterol in Serum and Urine.


2.3 Indian Medicinal Plants and Their Uses - Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothuvelai.
UNIT-III

3.2 Antiseptics and Disinfectants - Definition and Distinction - Phenolic compounds, Chloro compounds and Cationic surfactants.

3.3 Vitamins – Definition – Classification of Vitamins – Sources and Uses – Deficiency Diseases caused by Vitamins.

UNIT-IV
4.1 Analgesics – Definition - Classification - Narcotic and Non- narcotic – Antipyretic analgesics – Mechanism of action - Morphine and its derivatives - Pethedine and Methadone - Salicylic acid derivatives – Antipyretics and Antiinflammatory Agents - Definition and Actions – Aspirin, Paracetamol, Ibuprofen - Disadvantages and Uses.


4.3 Drugs affecting CNS - Definition, Distinction and Examples for Tranquilizers, Sedatives (Phenobarbital, Diazepam) - Hypnotics, Psychedelic Drugs – LSD, Hashish-Their effects.
UNIT-V

5.1 Antineoplastic Drugs - Causes and Types of Cancer - Treatment of Cancer – Antineoplastic Agents – Antimetabolites - AIDS - AZT, DDC.

5.2 Hormones – Definition - Classification – Physiological Functions of Insulin, Adrenaline, Thyroxin and Oxytacin.

5.3 Sex hormones – Androsterone, Testosterone, Progesterone and Estrogen - Biological functions – Disorders of Hyposecretion and Hypersecretion of Hormones.

Reference Books

7. A Text Book of Biochemistry - Ambika.S.
ELECTIVE
PAPER – 2
B. POLYMER CHEMISTRY

Objective:

- To impart Knowledge about the Types of Polymers, Polymerization Techniques, Commercial Polymers and their Applications.

UNIT-I


1.2 Bonding in Polymers – Primary and Secondary bond forces in Polymers – Cohesive energy and Decomposition of Polymers.

1.3 Chain Growth Polymerisation – Cationic, Anionic and Free radical polymerisation – Stereoregular polymers – Ziegler Natta polymers – Step Growth Polymers.

UNIT-II

2.1 Polymerization Techniques - Bulk, Solution, Suspension and Emulsion Polymerisation - Melt Polycondensation - Polymer Processing – Calendering - Die Casting and Rotational Casting.

2.2 Molecular weight of polymers – Number average – Weight average – Sedimentation and Viscosity – Average molecular weight - Molecular weight and Degree of Polymerisation – Methods of determination of Molecular Weight – Gel permeation chromatography – Ultracentrifugation.

UNIT-III


3.3 Adhesives – Shellac resins – Vegetable glues and Animal glues.

UNIT-IV

4.1 Chemistry of Commercial Polymers - General methods of Preparation and Uses of the following - Teflon, Polyethylene, PTFE, Polystyrene, Polycarbonates and PVC.


UNIT-V

5.1 Advances in Polymers - Biopolymers, Biomaterials, Polymers in Medical Field, High temperature and Fire Resistant Polymers – Applications of Silicones.

5.2 Conducting Polymers – Elementary idea – Examples – Polysulphur Nitriles,
Poly paraphenylene, Polypyrrole, Polythiophene, Polyaniline and Polyacetylene.

5.3 Acrylic polymers – Polymers of Acrylic Acid, Methacrylic Acid and Polyacrylates.

Reference Books

ELECTIVE
PAPER – 2
C. GREEN CHEMISTRY

Objective:

- To impart knowledge about Green Solvents, Green Techniques, Green Catalysts and Green Reactions.

UNIT-I Green Chemistry – Introduction


1.2 Green synthesis – Evaluation of the type of the reaction – Rearrangements (100 % Atom economic) - Addition reaction (100 % Atom economic).

1.3 Organic reactions by Sonication method – Apparatus required – Examples of Sonochemical Reactions (Heck, Hundsdiecker and Wittig reactions).

UNIT-II Green Solvents

2.1 Selection of Solvents – Aqueous Phase Reactions - Diels-Alder reaction in water – Catalysis in water (Aerobic Oxidation of Alcohols catalysed by Pd (II) / Bathophenanthroline).

2.2 Reactions in ionic liquids - Simple preparation – Types – Properties and Applications – Ionic liquids in Organic Reactions (Heck reaction, Suzuki reactions, Epoxidation), Industrial (Battery) and Analytical Chemistry (Matrices for MALDI-TOF MS, Gas Chromatography Stationary Phases) – Advantages and Disadvantages.

2.3 Solid Supported Synthesis - Supercritical CO₂ – Preparation, Properties and Applications (Decaffeination, Dry cleaning) – Environmental impact.

UNIT-III Green Techniques

3.1 Microwave and Ultrasound Assisted Green Synthesis – Apparatus required – Examples
of MAOS (Synthesis of Fused Anthroquinones, Leukart reductive Amination of Ketones) – Advantages and Disadvantages of MAOS – Aldol condensation – Cannizzaro condensation - Diel’s-Alder reaction – Strecker’s synthesis.

3.2 Photochemical reactions using Sunlight – Photoreduction of Benzophenone to Benzopinacol using Sunlight - Photochemical alternative to Friedel- Crafts reaction.

3.3 Nanoparticles - Introduction – Types of Nanoparticles – Techniques to prepare Nanoparticles – Top down and Bottom up approaches – Common growth methods.

UNIT-IV Green Catalysis


4.3 Micellar Catalysis, Surfactants and Synthesis in water – Principles, Materials and Synthetic Applications.

UNIT- V Green Reactions

5.1 Acetylation of Primary Amine, Base catalysed Aldol condensation (Synthesis of Dibenzalpropanone), Halogen addition to C = C bond (Bromination of Trans- Stilbene), [4+2] Cycloaddition reaction (Diels-Alder reaction between Furan and Maleic acid).

5.2 Rearrangement reaction (Benzil- Benzilic acid rearrangement), Coenzyme catalyzed Benzoin condensation (Thiamine hydrochloride catalysed synthesis of Benzoin), Pechmann condensation for Coumarin synthesis (Clay catalysed Solid State Synthesis of 7- Hydroxy- 4- methylcoumarin).
5.3 Electrophilic Aromatic Substitution Reactions (Nitration of phenol, Bromination of Acetanilide) – Green oxidation reactions (Synthesis of adipic acid, Preparation of Manganese (III) acetylacetonate) – Zeolite catalyzed Friedel-Crafts acylation.

**Books for Study**


**Books for Reference**

SKILL BASED SUBJECT
PAPER – 3
APPLIED CHEMISTRY

Objective:

- To impart Knowledge about Petrochemicals, Paper Technology, Sugar Industry, Explosives, Photography and Diary Chemistry,

UNIT I
1.2 Gobar Gas – Production – Feasibility and Importance of Biogas with special reference to Rural India.

UNIT II
2.2 Various processes - Beating, Refining, Filling, Sizing and Colouring.
2.3 Manufacture of Paper – Calendering – Uses.

UNIT III
3.1 Sugar industry - Sugar industries in India – Sugarcane and sugar beet - Manufacture of cane sugar – Extraction of juice – Concentration – Separation of crystals.
3.3 Preparation of Bagasse – Use of Bagasse for Manufacture of Paper and Electricity -
Preparation of Alcohol from Molasses - Preparation of Absolute Alcohol - Manufacture of Wine, Beer, Methylated Spirit and Power Alcohol.

UNIT IV

4.3 Coal – Classification by rank – Proximate and Ultimate analysis – Low and High Temperature Carbonisation – Otto-Hoffmann’s by-product - Distillation of Coal Tar.

UNIT V

5.1 Milk – Definition – Physico-Chemical properties of milk - Constituents of milk and Their Physico-chemical Properties.
5.2 Chemical change taking place in Milk due to Processing Parameters - Boiling, Pasteurisation, Sterilisation and Homogenisation.
5.3 Definition and Composition of Creams, Butter, Ghee and Ice Creams - Milk Powder - Definition, Need for making powder - Principles involved in Drying process - Spray drying and Drum drying.

Reference Books

Objectives:

- To impart knowledge about Nuclear chemistry, Radioactivity, Metallurgy, Chemistry of f- Block Elements, Organometallic Compounds and Bio-inorganic Chemistry.

UNIT-I NUCLEAR CHEMISTRY

1.1 Introduction - Composition of Nucleus – Fundamental Particles of Nucleus - Nuclear Forces operating between the Nucleons - N/P ratio – Nuclear Stability - The whole number rule and Packing fraction.
1.2 Isotopes, Isobars and Isotones – Detection and Separation of isotopes

UNIT-II RADIOACTIVITY

2.1 Natural Radioactivity – Properties of Alpha, Beta and Gamma rays - Detection and measurement of Radioactivity - Radioactive series including Neptunium series – Soddy’s Group Displacement Law.
2.2 Rate of disintegration and Half - Life period – Derivation - Average life period - Artificial Radioactivity - Induced Radioactivity - Uses of Radioisotopes - Hazards of radiations.
2.3 Nuclear fission - Nuclear energy - Nuclear reactors - Nuclear fusion -Thermonuclear reactions - Energy source of the Sun and Stars – Comparison of Nuclear Fission and Nuclear Fusion.

UNIT-III METALLURGY

3.2 Comparative study of Ti, V, Cr, Mn and Fe group elements with special reference to Occurrence, Oxidation States, Magnetic Properties and Colour.

3.3 Occurrence and Extraction of Ti, Mo, W and Co - Preparation and Uses of Ammonium Molybdate and V₂O₅.

UNIT-IV INNER TRANSITION ELEMENTS

4.1 General Characteristics of f- Block elements – Position of Lanthanides in the periodic table – Separation of Lanthanides (Ion exchange method).

4.2 Comparative study of Lanthanides and Actinides - Occurrence, Oxidation states, Magnetic properties, Colour and Spectra.

4.3 Lanthanide Contraction – Causes and Consequences - Comparison between Lanthanides and Actinides – Position of Actinides in the periodic table – Extraction of Thorium and Uranium

UNIT-V ORGANOMETALLIC COMPOUNDS AND BIOINORGANIC CHEMISTRY

5.1 Organometallic Compounds - Definition - Nomenclature – Classification – Organo-Lithium and Organo-Boron Compounds - Preparation, Properties, Structure and Uses.

5.2 Biological Functions of Iron, Copper and Zinc – Biologically Important Compounds – Myoglobin, Cytochrome, Haemoglobin and Ferritin.

5.3 Binary Metallic Compounds – Hydrides, Borides, Carbides and Nitrides – Classification - Preparation, Properties, Structure and Uses.
CORE PRACTICAL
PAPER – 3
GRAVIMETRIC ESTIMATION

1. Estimation of Sulphate as Barium Sulphate.
2. Estimation of Barium as Barium Sulphate.
3. Estimation of Barium as Barium Chromate.
4. Estimation of Lead as Lead Chromate.
5. Estimation of Calcium as Calcium Oxalate Monohydrate.

References

OBJECTIVES:

➢ To kindle interest in students in learning Bio-organic chemistry through the introduction of topics such as Proteins, Nucleic acids, Terpenes, Alkaloids etc.

➢ To generate Keen Interest and Thinking in Understanding the Mechanisms of Molecular Rearrangements and Synthetic Applications of Acetoacetic Ester, Benzene Diazonium Chloride, Grignard Reagents and Diazomethane.

UNIT- I Molecular rearrangements

1.1 Rearrangements - Classification – Anionotropic, Cationotropic and Free Radical Rearrangements - Intermolecular and Intramolecular Rearrangements – Examples – Cross over experiment – Differences between Intermolecular and Intramolecular rearrangements.

1.2 Mechanisms, Evidences, Migratory Aptitude, Intermolecular or Intramolecular nature of the following rearrangements - Pinacol-Pinacolone, Benzil-Benzilic acid and Beckmann rearrangement.

1.3 Mechanism of Hoffmann, Curtius, Baeyer-Villiger, Claisen (Sigmatropic), Fries rearrangement, Cope and Oxy-Cope rearrangements.

UNIT-II Amino acids and Polypeptides

2.1 Amino acids – Classification - Essential and Non- Essential amino acids – Acidic, Basic and Neutral Amino Acids – Alpha, Beta and Gamma- Amino acids - Preparation of alpha amino acids – Gabriel’s Phthalimide synthesis, Strecker synthesis and Erlenmeyer Azlactone synthesis - Glycine, Alanine and Tryptophan.

2.2 General properties of Amino acids - Reactions of Amino acids due to Amino group and Carboxyl group - Zwitterions - Isoelectric point.

UNIT- III Proteins and Nucleic Acids

3.1 Proteins - Definition - Classification based on Physical Properties, Chemical Properties and Physiological Functions - Primary and Secondary Structure of Proteins - Helical and Beta Sheet Structures (Elementary Treatment Only) – Denaturation of Proteins.

3.2 Nucleic acids – Nucleoproteins - Definition - Types of Nucleic Acids – RNA and DNA - Nucleoside, Nucleotide, Degradation of Nucleotide Chain - Components of RNA and DNA.

3.3 Differences between DNA and RNA - Structures of Ribose and 2- Deoxyribose – Double Helical Structure of DNA - Biological functions of Nucleic Acids - Elementary ideas on Replication and Protein Synthesis.

UNIT-IV Chemistry of Natural Products

4.1 Antibiotics – Definition – Structural elucidation of Penicillin and Chloramphenicol – Uses of Penicillin and Chloramphenicol.

4.2 Alkaloids – Classification – Isolation of alkaloids – General methods of Determination of structure of Alkaloids - Synthesis and Structural Elucidation of Piperine, Coniine and Nicotine.

4.3 Terpenoids – Definition - Classification - Isoprene rule - Synthesis and Structural elucidation of Citral, Menthol and Alpha- pinene.

UNIT- V Organo-Synthetic Reagents

5.1 Acetoacetic ester – Preparation by Claisen ester condensation – Reactions – Synthetic Applications.

5.2 Benzene diazonium chloride – Preparation from aniline – Synthetic Applications – Coupling reactions.

Analysis of organic compounds containing one functional group and characterisation with a derivative.

**Reactions of the following Functional Groups:**

Aldehyde, Ketone, Carboxylic Acid (Mono and Di), Ester, Carbohydrate (Reducing and Non-Reducing), Phenol, Aromatic Primary Amine, Amide, Nitro Compounds, Diamide and Anilide.

**Organic Preparations**

**Acylation**

1. Acetylation of Salicylic acid or Aniline.
2. Benzoylation of Aniline or Phenol.

**Nitration**

3. Preparation of m- Dinitrobenzene
4. Preparation of p- Nitroacetanilide

**Halogenation**

5. Preparation of p- Bromoacetanilide
6. Preparation of 2,4,6-Tribromophenol

**Diazotisation /Coupling**

7. Preparation of Methyl Orange

**Oxidation**

8. Preparation of Benzoic Acid from Toluene or Benzaldehyde.
Hydrolysis

9. Hydrolysis of Ethyl Benzoate (Or) Methyl Salicylate (Or) Benzamide.

Reference Books

- Vogel’s Text Book of Chemical Analysis
- Practical Chemistry - A. O. Thomas - Scientific Book Center, Cannanore.
- Practical Chemistry - 3 Volumes - S. Sundaram and others.
PAPER- 10

PHYSICAL CHEMISTRY – II

Objectives:

- To impart Knowledge about Electrochemistry, Surface Chemistry, Photochemistry, Chemical Kinetics and Theories of reaction rates.

UNIT- I Electrochemistry - III
1.2 Derivation of Nernst equation for Electrode Potential and Cell emf – Types of reversible electrodes - Electrode reactions - Electrode potentials.

UNIT- II Electrochemistry - IV
2.1 Liquid Junction Potential - Concentration cells With Transference and Without Transference.
2.2 Applications of Concentration cells - Valency of ions, Solubility and Solubility Product - Activity Coefficient of electrolytes - Determination of pH using Hydrogen, Quinhydrone and Glass electrodes – Potentiometric titrations.

UNIT- III Chemical Kinetics
3.1 Definitions of the terms – Order and Molecularity – Rate of the reaction - Derivations of expressions for Zero, First, Second and Third order rate equations - Study of kinetics by Volumetric, Polarimetric and Spectrophotometric methods - Methods of Determination of Order of a reaction.
3.2 Effect of Temperature on reaction rate - Arrhenius equation - Theories of reaction rates – Bimolecular Collision Theory – Lindmann’s theory of Unimolecular Reactions.
3.3 ARRT - Thermodynamic treatment of ARRT – Eyring equation - Comparison of Collision Theory and ARRT.

UNIT- IV Surface Chemistry

4.3 Homogeneous catalysis – Function of a catalyst in terms of Gibb’s free energy of activation - Heterogeneous catalysis - Kinetics of Unicellular Surface Reactions.

UNIT- V Photochemistry

5.1 Laws of photochemistry - Grothus-Draper law, Stark-Einstein’s law – Primary and Secondary processes – Quantum yield and its determination.
5.2 Qualitative description of Fluorescence, Phosphorescence, Luminescence, Chemiluminescence, Bioluminescence and Photosensitized Reactions.
5.3 Kinetics of Photochemical Reactions - H2-Cl2 and H2-Br2 reactions - Photodimerisation of Anthracene
REFERENCE BOOKS

INORGANIC CHEMISTRY


ORGANIC CHEMISTRY

15. Organic Chemistry - Bruice - Pearson Education.
PHYSICAL CHEMISTRY

4. Physical Chemistry - Kundu and Jain - S. Chand & Co.
CORE PRACTICAL  
PAPER – 5  
PHYSICAL CHEMISTRY EXPERIMENTS

1. Kinetics  
Determination of the Order of the following reactions  
a) Acid catalysed Hydrolysis of an Ester (Methyl or Ethyl acetate)  
b) Saponification of an Ester (Methyl or Ethyl Acetate)  
c) Iodination of Acetone.

2. Molecular weight of a solute - Rast’s method using Naphthalene or Diphenyl as Solvents.

3. Heterogeneous equilibria  
   a) *Phenol-Water system – CST  
   
   b) Effect of impurity – 2 % NaCl or Succinic acid solutions on Phenol -Water system - Determination of the Concentration of the given solution

4. Determination of the Transition Temperature of the given salt hydrate. Na₂S₂O₃.5H₂O, CH₃COONa.3H₂O, SrCl₂.6H₂O, MnCl₂.4H₂O

5. Electrochemistry  
Conductivity  
   a) Determination of Cell Constant and Equivalent Conductivities of the solutions of two different concentrations.  
   
   b) Conductometric titration of a Strong Acid against a Strong Base.

6. Potentiometric titration of a Strong Acid against a Strong Base.


*Need not be given in examination.

Students must write Short Procedure / Formula with explanation in Ten Minutes for evaluation during the university practical examination.
ELECTIVE
PAPER – 3
A. ANALYTICAL CHEMISTRY – II

Objective:

- To impart knowledge about Different Chromatographic and Spectroscopic Techniques.

UNIT – I


UNIT – II

2.1 High Pressure Liquid Chromatography and Gas Chromatography – Principle and Applications.

2.2 Gas Chromatography – Mass Spectrophotometer (GC-MS) - Liquid Chromatography - Mass Spectrophotometer (LC-MS) - Principle and Applications.
2.3 Polarography – Principle – DME – Advantages and Disadvantages – Ilkovic equation and its significance (No Derivation) - Polarography as an Analytical tool in Quantitative and Qualitative Analysis – Amperometric Titrations.

UNIT – III

3.1 NMR Spectroscopy – Principle of Nuclear Magnetic Resonance – Basic Instrumentation.

3.2 Number of Signals – Chemical Shift – Shielding and Deshielding – Factors influencing Chemical Shift - Spin-Spin Coupling and Coupling constants - TMS as NMR standard.

3.3 Splitting of Signals – NMR Spectra of simple Organic Molecules – Applications in Structural Elucidation.

UNIT – IV

4.1 Mass Spectroscopy – Basic principles of Mass Spectrum - Instrumentation – Molecular ion peak- Base peak - Metastable peak - Isotopic peak and their Uses.

4.2 Fragmentation – Factors affecting Cleavage Patterns - Nitrogen rule – Ring rule – McLafferty rearrangement - Determination of Molecular Formulae with examples.

4.3 Mass spectrum of simple organic compounds – Identification – Alcohols, Aldehydes and Aromatic hydrocarbons.

UNIT – V


5.2 Thermoanalytical methods – Principle involved in Thermogravimetric analysis (TGA) and Differential Thermal Analysis (DTA) – Instrumentation- Discussion of Various Components with Block Diagram.
5.3 Characteristics of TGA (CaC$_2$O$_4$.H$_2$O, CuSO$_4$.5H$_2$O) and DTA curves – Factors Affecting TGA and DTA Curves – Thermometric Titrations – Principle and Applications.

Reference Books

ELECTIVE PAPER – 2
B. TEXTILE CHEMISTRY

Objective:

- To impart knowledge about the Production, Properties and Applications of Natural and Synthetic Fibres, Colour and Constitution, Classification of Dyes and Concept of Dyeing in Textile Industry.

UNIT – I
1.1 General Classification of Fibres – Chemical structure – Production – Properties – Count, Denier, Tex, Staple Length, Spinning Properties, Strength, Elasticity and Creep.
1.2 Applications of the following Natural Cellulose Fibres (Cotton and Jute).
1.3 Natural Protein Fibres (Wool and Silk) – General characteristics.

UNIT – II
2.1 Chemical Structure, Production and properties of the following Synthetic Fibres - Man-made Cellulose Fibres (Rayon and Modified cellulose fibres).
2.2 Polyamide Fibres (Different types of Nylons) - Preparation – Nylon degradation – Polyester Fibres – Preparation - Degradation – Polyacrylonitrile fibre - Preparation and Properties – Viscose fibre - Preparation and Properties.
2.3 Identification tests for Cellulose, Cotton, Wool, Silk, Rayon, Acrylic, Viscose, Polyamide and Polyester Fibres.

UNIT – III
3.1 Impurities in Raw Cotton and Grey Cloth, Wool and Silk.
3.2 General principles of the Removal, Scouring - Purpose, Alkali Scouring and Acid Scouring – Bleaching (Methods - Hypochlorite, Peroxide and Bleaching Powder) - Desizing (Hydrolytic and Enzymatic), Kier Boiling and Chemicking.

3.3 Dyeing of Polyester and Blends – Functions of Dispersing agents - Fibre swelling – Carrier dyeing - High temperature dyeing - Selection of dyestuff.
UNIT – IV

4.1 Colour and Constitution – A general treatment – Chromophores – Auxochromes - Bathochromes and Hypsochromes.

4.2 Classification of dyes – Acidic, Basic, Direct, Mordant, Azoic, Ingrain, Vat and Reactive Dyes - Classification as per Chemical constitution – Azo dyes – Triphenyl Methane Dyes, Phthalein Dyes, Indigo and Anthraquinone Dyes.

4.3 Structure, Preparation and Uses – Methyl Orange, Phenolphthalein and Malachite Green.

UNIT – V

5.1 Dyeing - Dyeing of Wool and Silk – Fastness properties of dyed materials.

5.2 Dyeing of Nylon, Terylene and other Synthetic Fibres – Finishing – Finishes given to Fabrics – Mechanical finishes on Cotton, Wool and Silk.

5.3 Method used in process of Mercerizing – Anticrease and Antishrink finishes – Water Proofing.

References

- The Identification of Textile Fibres - Bruno Nuntak.
- Scouring and Bleaching, E. R. Trotman, Charles Griffin & Co Ltd.
- A Students Text Book of Textile Science – A. J. Hall.
ELECTIVE
PAPER – 3
C. NANO CHEMISTRY

Objectives:

- To introduce the Basics of Nanotechnology.
- To learn the Instrumental Techniques used in Characterisation of Nanomaterials.

UNIT-I Basics of Nanochemistry


UNIT-II Nanoparticles


UNIT-III Synthetic Techniques

Techniques to Synthesise Nanoparticles – Top down and Bottom up Approaches – Common Growth Methods – Characterisation of Nanoparticles – Applications and Toxic effects of Nanomaterials.

UNIT-IV Nanomaterials

Preparation, Properties and Applications of Carbon Nanotubes, Nanorods, Nanofibres and Nanoclays.
UNIT-V Instrumental Techniques


Books for Study


Books for Reference

SKILL BASED SUBJECT
PAPER – 4
AGRICULTURE AND LEATHER CHEMISTRY

OBJECTIVE:

- To learn about Soil fertility and Productivity, Soil Chemistry, Insecticides, Leather Industry and Treatment of Tannery Effluents.

Unit-I Soil Chemistry


1.3 Soil Fertility – Carbon and Nitrogen cycle - Acid, Alkaline and Saline soils – Their Formation - Reclamation – Liming agents.

UNIT-II Fertilisers and Manures


2.2 Manures – Compost – Composting - Methods of Composting - Farmyard Manure, Vermicompost, Composted Coconut Coir Pith, Press mud and Poultry manure – Applications.

2.3 Types of pollutions caused by Fertilisers - Ill effects of Fertilisers and their Control.
UNIT-III Insecticides and Fungicides

3.1 Insecticides – Definition - Classification of Insecticides - Stomach poisons - Contact poisons and Fumigants - Insecticides - Organic Insecticides - DDT - Gammexane - Malathion – Parathion.


3.3 Herbicides - Rodenticides - Pesticides in India - Adverse Environmental Effects of Pesticides.

UNIT- IV Leather Chemistry


4.2 Manufacture of Leather - Leather Tanning methods - Vegetable Tanning – Chemistry of Chrome Tanning and Mineral Tanning – Deliming.

4.3 Dyeing of Leather and Fat Liquoring - Leather Finishing - Oil Tanning - By products.

UNIT- V Tannery Effluents

5.1 Tannery effluents - Pollution and its control - Water pollution and Air pollution - Waste Management.

5.2 Treatment of Tannery Effluents - Primary, Secondary and Tertiary treatment - Pollution Prevention.

5.3 Effect of Tannery Effluents on Agriculture – Organic Amendments - Reclamation of Tannery Effluents Affected Soil.
Reference Books

- Fundamental Concept of Applied Chemistry by Jayashree Ghosh, S. Chand & Company Ltd.,
- Soil Science - A. Sankara.
SCHEME OF VALUATION FOR PRACTICAL EXAMINATIONS

PRACTICAL – I

VOLUMETRIC ANALYSIS

Internal assessment: 25 Marks
External assessment: 75 Marks
Total: 100 marks
Record: 15 Marks
Procedure: 10 Marks

Error upto
2 % : 50
2.1 – 3 % : 40
3.1 – 4 % : 30
4.1 – 5 % : 20
>5 % : 10

For incomplete or wrong calculation deduct 20 % of total marks scored.
For no calculation deduct 40 % of total marks scored.
For each arithmetic error deduct 1 mark.

CORE PRACTICAL – II

INORGANIC QUALITATIVE ANALYSIS AND PREPARATION

Internal assessment: 25 Marks
External assessment: 75 Marks
Total: 100 marks
Record: 15 Marks
Preparation: 20 (Quantity- 15 Marks; Quality- 5 marks)
Analysis: 40 Marks.
Each radical with procedure: 10 Marks
(Spotting for each radical - 5 Marks; Fixing the group - 5 Marks)
PRACTICAL - III
GRAVIMETRIC ANALYSIS

Internal assessment: 25 Marks
External assessment: 75 Marks
Total: 100 marks
Record: 15 Marks
Procedure: 10 Marks

Error upto 2 % : 50
2.1 – 3 % : 40
3.1 – 4 % : 30
4.1 – 5 % : 20
>5 % : 10

a. Among the duplicate results, the value more favorable to the candidate must be taken.
b. When no duplicate result is given deduct 5 marks.
c. If the two results differ by more than 2 % deduct 5 marks.
d. For each independent arithmetical error deduct 1 mark.
e. For incomplete or wrong calculation deduct 20 %.
f. For no calculation deduct 40 %.
g. If the experiment is not completed due to an accident, award 5 marks.
PRACTICAL - IV
ORGANIC ANALYSIS

Internal assessment: 25 Marks
External assessment: 75 marks
Total: 100 marks
Record: 15 Marks
Preparation: 15 (quantity: 10 & quality: 5)
Analysis: 45
Preliminary reaction: 4
Aliphatic/ Aromatic: 4
Saturated/ Unsaturated: 4
Tests for elements: 9
Functional groups: 10
Confirmatory tests: 10
Derivative/Coloured reaction: 4

PHYSICAL CHEMISTRY PRACTICALS

Internal assessment: 25 Marks
External assessment: 75 Marks
Total: 100 Marks
Record: 15 Marks
Experiment: 45 Marks
Manipulation, Tabulation and Calculation: 15 Marks

1) **Kinetics**
   
   Graph : 10 Marks
   Below a factor of 10 : 35
   By a factor of 10 : 25
   More than a factor of 10 : 15
2) **Molecular weight**

   Error upto 10 %: 45
   
   20 %: 35
   
   30 %: 25
   
   > 30 %: 15

3) **Effect of electrolyte on CST**

   Graph: 10
   
   Error upto 10 %: 35
   
   20 %: 25
   
   30 %: 15
   
   > 30: 10

4) **Transition temperature**

   Graph: 10
   
   Error upto 2ºC difference: 35
   
   7ºC difference: 25
   
   > 7ºC difference: 15

5) **Conductance**

   **Equivalent conductance: 25 marks**
   
   Error upto 10 %: 25
   
   Upto 15 %: 15
   
   > 15 %: 10

   **Cell constant: 20 marks**
   
   Error upto 10 %: 20
   
   Upto 15 %: 15
   
   > 15 %: 10

6) **Conductometric titration**

   Graph: 10
   
   Upto 2 %: 35
   
   2.1 to 3 %: 30
   
   3.1 to 4 %: 25
   
   4.1 to 5 %: 20
   
   > 5%: 15