THIRUVALLUVAR UNIVERSITY

B.Sc., CHEMISTRY DEGREE COURSE

CBCS PATTERN
(With effect from 2017 - 2018)
The Course of Study and the Scheme of Examinations

S.NO.	Part	Study Components / Course Title		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
SEMESTER I							**CIA**	**Uni. Exam**	**Total**
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English	Paper-1	6	4	English	25	75	100
3	III	Core Theory	Paper-1	6	6	General Chemistry - I	25	75	100
	III	Core Practical	Practical-1	3	0	Volumetric Analysis	0	0	0
4	III	Allied -1	Paper-1	4	4	**Any one from** 1. Physics –I 2. Botany –I 3. Zoology –I 4. Biochemistry – I 5. Mathematics – I*	25	75	100
	III	Allied Practical	Practical-1	3	0	Allied practical-1	0	0	0
5	IV	Environmental Studies		2	2	Environmental studies	25	75	100
				30	**20**		**125**	**375**	**500**
SEMESTER II							**CIA**	**Uni. Exam**	**Total**
6	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
7	II	English	Paper-2	4	4	English	25	75	100
8	III	Core Theory	Paper-2	6	5	General Chemistry - II	25	75	100
9	III	Core Practical	Practical-1	3	3	Volumetric Analysis	25	75	100
10	III	Allied-1	Paper-2	4	4	**Any one from** 1. Physics –II 2. Botany –II 3. Zoology –II 4. Biochemistry – II 5. Mathematics – II*	25	75	100
11	III	Allied Practical	Practical-1	3	2	Allied practical-1	25	75	100

S.NO.	Part	Study Components Course Title		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
12	IV	Value Education		2	2	Value Education	25	75	100
13	IV	Soft Skill		2	1	Soft Skill	25	75	100
				30	**25**		**150**	**650**	**800**
SEMESTER III							**CIA**	**Uni. Exam**	**Total**
14	I	Language	Paper-3	6	4	Tamil / Other Languages	25	75	100
15	II	English	Paper-3	6	4	English	25	75	100
16	III	Core Theory	Paper-3	3	3	General Chemistry – III	25	75	100
	III	Core Practical	Practical-2	3	0	Inorganic Qualitative Analysis & Preparations	0	0	0
17	III	ALLIED-2	Paper-3	4	4	**Any one from** 1. Physics –I 2. Botany –I 3. Zoology –I 4. Biochemistry – I 5. Mathematics – I*	25	75	100
	III	Allied Practical	Practical-2	3	0	Allied practical-II	0	0	0
18	IV	Skill Based Subject	Paper-1	3	3	Water Treatment and Analysis	25	75	100
19	IV	Non-Major Elective	Paper-1	2	2	Medicinal Chemistry	25	75	100
				30	**20**		**150**	**450**	**600**
SEMESTER IV							**CIA**	**Uni. Exam**	**Total**
20	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
21	II	English	Paper-4	6	4	English	25	75	100
22	III	Core Theory	Paper-4	3	3	General Chemistry - IV	25	75	100
23	III	Core Practical	Practical-2	3	3	Inorganic Qualitative Analysis & Preparations	25	75	100
24	III	Allied-2	Paper-4	4	4	**Any one from** 1. Physics –II 2. Botany –II 3. Zoology –II 4. Biochemistry – II 5. Mathematics – II*	25	75	100
25	III	Allied Practical	Practical-2	3	2	Allied practical-II	25	75	100
26	IV	Skill Based Subject	Paper-2	3	3	Food Chemistry	25	75	100
27	IV	Non-Major Elective	Paper-2	2	2	Chemistry in Every Day Life	25	75	100
				30	**25**		**200**	**600**	**800**

S.NO.	Part	Study Components / Course Title		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
SEMESTER V							**CIA**	**Uni. Exam**	**Total**
28	III	Core Theory	Paper-5	4	4	Inorganic Chemistry - I	25	75	100
	III	Core Practical	Practical-3	3	0	Gravimetric Estimation	0	0	0
29	III	Core Theory	Paper-6	4	4	Organic Chemistry – I	25	75	100
	III	Core Practical	Practical-4	3	0	Organic Analysis and Preparations	0	0	0
30	III	Core Theory	Paper-7	4	4	Physical Chemistry – I	25	75	100
	III	Core Practical	Practical-5	3	0	Physical Chemistry	0	0	0
31	III	Elective	Paper-1	3	3	**Any one from** A. Analytical chemistry – I B. Basis of computer programming in C and its applications in Chemistry C. Organic Synthesis	25	75	100
32	III	Elective	Paper - 2	3	3	**Any one from** A. Pharmaceutical Chemistry B. Polymer Chemistry C. Green Chemistry	25	75	100
33	IV	Skill Based Subject	Paper - 3	3	3	Applied chemistry	25	75	100
				30	**21**		**150**	**450**	**600**
SEMESTER VI							**CIA**	**Uni. Exam**	**Total**
34	III	Core Theory	Paper-8	5	5	Inorganic Chemistry – II	25	75	100
35	III	Core Practical	Practical-3	3	3	Gravimetric Estimation	25	75	100
36	III	Core Theory	Paper-9	5	4	Organic Chemistry – II	25	75	100
37	III	Core Practical	Practical-4	3	3	Organic Analysis & Preparations	25	75	100
38	III	Core Theory	Paper-10	5	4	Physical Chemistry – II	25	75	100
39	III	Core Practical	Practical-5	3	3	Physical Chemistry Experiments	25	75	100
40	III	Elective	Paper-3	3	3	**Any one from** A. Analytical chemistry - II B. Textile chemistry C. Nano Chemistry	25	75	100
41	IV	Skill based Subject	Paper-4	3	3	Agriculture and Leather Chemistry	25	75	100
42	V	Extension Activities		-	1	Extension Activities	100	0	100
		TOTAL		**30**	**29**		**300**	**600**	**900**

Part	Subject	Papers	Credit	Total credits	Marks	Total Marks
Part I	Languages	4	4	16	100	400
Part II	English	4	4	16	100	400
Part III	Allied (Odd Semester) *	2	4	8	100	200
	Allied (Even Semester) *	2	4	8	100	200
	Allied Practical (Even Semester)	2	2	4	100	200
	Electives	3	3	9	100	300
	Core (Theory & Practicals)	15	(3-6)	57	100	1500
Part IV	Environmental Science	1	2	2	100	100
	Soft skill	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others/NME	2	2	4	100	200
	Skill Based	4	3	12	100	400
Part V	Extension	1	1	1	100	100
	Total	**42**		**140**		**4200**

* **Allied Mathematics**:

	Ins. Hrs/Week	Credit	CIA	University	Total Marks
Paper-1	7	4	25	75	100
Paper-2	7	6	25	75	100

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:

Basic concepts regarding Atomic Structure, Periodic Properties, Bonding Concepts, Ionic Bond, VSEPR and MO Theories, Nomenclature of Organic Compounds, Hybridisation, Reaction Intermediates, States of Matter, Principle of Volumetric Analysis, Related Problems and Applications wherever necessary are to be taught for I- Semester.

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 BF_3 , NH_3 , H_2O, PCl_5 and SF_6 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 H_2, He_2, O_2, N_2, F_2 and CO - Bond Order - Stability and Magnetic properties of the molecules - Comparison of VB and MO theories.

UNIT- III BASIC CONCEPTS OF ORGANIC CHEMISTRY

3.1 Classification of Organic Compounds – Nomenclature of Organic Compounds – Functional Groups - Homologous Series - IUPAC Recommendations for Naming Simple Aliphatic and Alicyclic Compounds.

3.2 Basic concepts of bonding in organic chemistry - Hybridisation – Definition – Geometry of Molecules - Methane, Ethane, Ethylene, Acetylene and Benzene - Electron displacement effects - Inductive - Inductomeric - Electromeric – Mesomeric Effect - Resonance - Hyperconjugation and Steric Effects.

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.

4.3 Solid State - Crystal lattices - Laws of Crystallography - Symmetry elements in crystals - Seven crystal systems - Unit cell - Space lattice - Bravais lattices - Law of Rational Indices - Miller indices.

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.

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1. PHYSICS - I

UNIT – I: PROPERTIES OF MATTER

Elasticity : Hooke's Law – Elastic Constants – bending of beam – Bending moment – Cantilever Depression at the loaded end of a cantilever – determination of Young's modulus by non-uniform bending.

Torsion : Torsion couple – Potential energy in a twisted wire – Torsional pendulum – Time period – Determination of rigidity modulus by Torsional oscillation (without masses).

Viscosity: Viscosity of a liquid – Viscous force – Co-efficient of viscosity of a liquid – Poiseuille's formula .

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

UNIT – II: HEAT

Heat: Specific heat – Newton's law of cooling – determination of specific heat of a liquid using Newton's law of cooling – Emissivity and Emissive Power.
Low Temperature: J.K. Effect – Positive Effect – Negative Effect – Temperature of Inversion – Super conductors. Type I and II – Meisner Effect – Helium I and II.

UNIT – III: ELECTRICITY AND MAGNETISM

Electricity: Potentiometer – Principle – Calibration of low range voltmeter – Measurement of internal resistance of cell – measurement of an unknown resistance.

Magnetism – Moment and pole strength of a magnet – Deflection magnetometer – Tan C position – Vibration magnetometer – Theory – Period of Oscillation – Determination of M and B_H using the deflection magnetometer in Tan C position and the vibration magnetometer.

UNIT – IV: SOUND AND ACOUSTICS OF BUILDING

Sound: Transverse vibration of strings – Velocity and frequency of vibrations of a stretched string – laws – sonometer – A.C. Frequency – Steel Wire – Brass wire.

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.

Diffraction: Theory of transmission grating – Normal Incidence – Determination of Wavelength of monochromatic source and Wavelength of mercury line using a grating by normal Incidence.

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

Books for Study & Reference

1. Allied Physics – R. Murugesan S. Chand & Co. First Edition (2005).
2. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics – Prof. Dhanalakshmi and others.
4. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
5. Heat and Thermodynamics – N. Brijlal and Subramaniam S. Chand & Co.
6. A text book of Sound – by M. Narayanamoorthy and other National Publishing Companies (1986).
7. Modern Physics – R. Murugesan S. Chand & Co. (2004).
8. Introduction to Fibre optics- K.Thyagarajan and Ajay Ghatak,Cambridge,University Press(1999).

ALLIED

3. ZOOLOGY I

Objective:

To acquire knownledge about different kinds of animal species.

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

UNIT – I:
Type study includes life history.

Protozoa - Entamoeba, **Porifera** - Sycon. **Coelenterata** - Obelia geniculata. **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.

Chordata - Genaral charters, **Prochordata:** Morphology of Amphioxus. **Vertebrates: Pisces** - Shark.

UNIT - IV

Amphibia: Frog, **Reptiles:** Calotes

UNIT - V

Aves: Pigeon, **Mammalia:** Rabbit.

REFERENCES:

1. Ayyar, E.K. and T.N. Ananthakrishnan. 1992. Manual of Zoology. Vol I & II, S. Viswanathan (printers and publishers) Pvt. Ltd., Madras, 891 p.

2. Kotpal series, 1998 - 1992. Rastogi Publications, Meerut.

3. Jordan E.L. and P.S. Verma. 1993. Invertebrate Zoology 12th edition, S. Chand & Co., Ltd., New Delhi.

4. Jordan, E.L., and P.S. Verma. 1995. Chordate Zoology and Elements of Animal Physiology, S. Chand & Co., Ltd., New Delhi.

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.
2. Harper's Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, and Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
6. Biomolecules-C. Kannan , MJP Publishers, Chennai - 5.

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 $\sin^n \theta$, $\cos^n \theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ - Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of θ.

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:

P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics,* Vol. I & II.Muhil Publishers, Chennai.

Reference Books:

1. P.Balasubramanian and K.G.Subramanian,(1997) *Ancillary Mathematics.* Vol. I & II. Tata McGraw Hill, New Delhi.
2. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II. VikasPublications, New Delhi.
3. P.R.Vittal (2003) *Allied Mathematics* .Marghan Publications, Chennai
4. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand& company Ltd., New Delhi-55.
5. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai.

SEMESTER 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 - $NaBH_4$ - Preparation and Uses.

UNIT-II HYDROCARBONS

2.1 Alkanes - Methods of preparation of alkanes - Wurtz method, Kolbe's method and Reduction of alkyl halides - Physical and Chemical Properties of alkanes - Mechanism of Free Radical Substitution in alkanes – Halogenation and Reactivity.

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, BH_3, Ozonolysis, Hydroxylation with $KMnO_4$ - Allylic substitution by NBS.

2.3 Alkynes - Acidity of alkynes - Addition of hydrogen - Hydroboration - Hydrohalogenation - Addition of hypohalous acid, Hydration - Addition of water with $HgSO_4$ catalyst - Oxidation with $KMnO_4$ – Ozonolysis - Formation of Acetylides.

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 H_2 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

4.1 Planck's Quantum theory of radiation - Photoelectric Effect - Compton Effect - Wave mechanical concept of the atom - de Broglie's relationship – Davisson and Germer experiment - Wave nature of electron - Heisenberg's Uncertainty Principle.

4.2 Schrodinger wave equation (Without derivation) - Significance of wave functions ψ and ψ^2 - 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

5.1 Thermodynamic processes - Types of processes - Cyclic - Reversible – Irreversible - Isothermal – Adiabatic Process - Exact and Inexact Differentials - Concept of Heat and Work - Zeroth Law of Thermodynamics.

5.2 First law of Thermodynamics - Statement and Equation – C_p and C_v Relationship - Calculation of W, Q, ΔE and ΔH 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 ΔH from ΔE 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

3. Estimation of HCl – Standard Oxalic Acid.

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

8. Estimation of Ferrous Iron using Diphenyl amine / N- pPhenylanthranillic acid as indicator.

Precipitation titration

9. Estimation of Chloride in neutral medium (Demonstration experiment).

Permanganometry

10. Estimation of Ferrous Sulphate – Standard FAS.

11. Estimation of Oxalic Acid – Standard Oxalic Acid.

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

ALLIED – 2

1. PHYSICS II

UNIT – I: WAVE MECHANICS

Wave Mechanics – De Broglie Waves – Dual Nature – Experimental Study of Matter Waves – Davission and Germer's Experiment – G.P. Thomson's Experiment _ Heisenberg's uncertainty Principle – The position and moment of a particle.

UNIT – II : NUCLEAR PHYSICS

Particle accelerators – cyclotron, particle detectors – GM Counter Artificial Transmutation – Rutherford's Experiment – The Q value equation for nuclear reaction – Threshold energy – Nuclear Reactions.

Conservation Laws: Conservation of Charge – Conservation of Nucleons – Conservation of Mass – Energy – Conservation of Parity – Quantities conserved and quantities not conserved in a nuclear reaction.

UNIT – III : ENERGY PHYSICS

Sources of conventional energy – Need for non-conventional energy resources – solar energy utilization – solar water heater – solar drier – conversion of light into electrical energy – solar cell – merits and demerits of solar energy – wind energy – its conversion systems – energy from Bio mass – Bio gas generation – Industrial and space application.

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

1. Allied Physics – R. Murugesan S. Chand & Co. First Edition (2005).
2. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
3. Allied Physics – Prof. Dhanalakshmi and others.
4. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
5. Heat and Thermodynamics – N. Brijlal and Subramaniam S. Chand & Co.
6. A text book of Sound – by M. Narayanamoorthy and other National Publishing Companies (1986).
7. Modern Physics – R. Murugesan S. Chand & Co. (2004).
8. Electronic Principles and Applications – A.B. Bhattacharya, New Central Book Agency, Calcutta.
9. Introduction to Solid State Physics – C. Kittel, 5^{th} Edition Wiley Eastern Ltd.
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

Cell Biology - structure of animal cell, **Genetics:** molecular structure of gene - gene function, sex linked inheritance. Genetic Engineering and its application.

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

Environmental Biology - Biotic factors and Abiotic factors, food chain and food web. Pollution - Environmental degradation, (Air, Water and Land) - Green house effect - Bioremediation, Biodegradation - Global warming - acid rain.

UNIT - V

Evolution: Theories of Lamarkism & Darwinism.

REFERENCES:

1. Ekambaranatha Ayyar, and Ananthakrishnan, T.N. 1993. Outlines of Zoology, Vol I & II, Viswanathan and Co, Madras.
2. Sambasiviah, I, Kamalakara Rao, A.P., Augustine Chellappa, S. 1983. Text book of Animal Physiology, S. Chand & Co., New Delhi.
3. Verma and Agarwal. 1983. Text book of animal Ecology, S. Chand & Co., New Delhi.
4. Verma and Agarwal and Tyagi. 1991. Chordate Embryology, S. Chand & Co., New Delhi.
5. Rastogi and Jayaraj. 2000. Text book of Genetics. Rastogi publications, Meerut.
6. Verma and Agarwal. 2000. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Co., New Delhi.

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

Definition, classification of enzymes with one example. Mechanism of enzyme action - Lock and key mechanism, Induced Fit theory. Michaleis-Menton equation. Enzyme inhibition: competitive, uncompetitive and non competitive. Biological functions of enzymes.

UNIT-IV: Molecular Biology

Central dogma of molecular biology. DNA and RNA act as genetic material. Replication: Definition, types, mode of action of replication, mechanism of replication. General mechanism of transcription and translation. Genetic code.

UNIT-V: Vitamins

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

References:

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan worth Publishers.
2. Harper's Biochemistry-Robert K. Murray, Daryl K. Grammer, McGraw Hill, and Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
6. Biomolecules-C. Kannan, MJP Publishers, Chennai-5.

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

P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics*, Vol. I & II.Muhil Publishers, Chennai

Reference Books:

1. P.Balasubramanian and K.G.Subramanian,(1997)*Ancillary Mathematics*. Vol. I & II. Tata McGraw Hill, New Delhi.
2. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II.Vikas Publications, New Delhi.
3. P.R.Vittal(2003). *Allied Mathematics* .Marghan Publications, Chennai.
4. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand& company Ltd., New Delhi-55.
5. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai

ALLIED PRACTICAL

1. PHYSICS

(Any 15 Experiments)

1. Young's modulus – non uniform bending – pin and microscope.
2. Rigidity modulus – Static Torsion Method Using Scale and Telescope.
3. Ridigity modulus – Torsional oscillation method (without symmetric masses).
4. Determination of Co-efficient of Viscosity – Graduated Burette.
5. Surface Tension and Interfacial Tension – By drop weight method.
6. Specific Heat Capacity of a liquid – by Newton's Law of Cooling.
7. Sonometer – Determining A.C. Frequency. (Screw Gauge is given).
8. Sonometer – frequency of tuning fork.
9. Newton's Rings – Radius of Curvature.
10. Air Wedge – Determination of thickness of thin wire.
11. Spectrometer Grating – Minimum Deviation – Mercury Lines.
12. Spectrometer – Refractive Index of a liquid – Hollow Prism.
13. Potentiometer – Calibration of High Range Ammeter.
14. Potentiometer – Calibration of Low Range Voltmeter.
15. Determination of M and B_H using Deflection Magnetometer in Tan C position and vibration magnetometer.
16. Figure of merit and voltage sensitiveness of table galvanometer.
17. Construction of AND, OR gates using diodes and NOT by transistors.
18. Zener diode – Voltage Regulation.
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.

Sphygnomanometer, Stethoscope, Rain gauge.

REFERENCES:

1. Verma. P.S. 2011. A manual of practical Zoology - INVERTEBRATES. Chand & Co., Ltd., Ram Nagar, New Delhi.
2. Verma. P.S. 2011. A manual of practical Zoology - CHORDATES. Chand & Co., Ltd., Ram Nagar, New Delhi.

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.

SEMESTER – III

PAPER – 3

GENERAL CHEMISTRY – III

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

2.1 Carbon family – Group study - Comparative study of Elements with respect to Valency, Oxides, Halides, Hydrides and Oxyacids - Catenation - Comparison of Properties of Carbon and Silicon – Silicates - Classification and Structure - Silicones- Preparation, Properties and Uses.

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

5.1 Second Law of Thermodynamics - Need for the II Law of Thermodynamics - Spontaneous Process – Criteria of Spontaneity - Different Forms of Statements of the Second Law – Cyclic Process – Definition - Heat Engines.

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.

5.3 Entropy change of an Ideal Gas during Isothermal Process - Entropy changes in Cyclic, Reversible and Irreversible Processes - Entropy Changes in Physical Transformations - Calculation of Entropy Changes with Changes in T, V and P - Entropy of Mixing of Ideal Gases – Physical Significance of Entropy.

ALLIED

1. PHYSICS - I

UNIT – I: PROPERTIES OF MATTER

Elasticity : Hooke's Law – Elastic Constants – bending of beam – Bending moment – Cantilever Depression at the loaded end of a cantilever – determination of Young's modulus by non-uniform bending.

Torsion : Torsion couple – Potential energy in a twisted wire – Torsional pendulum – Time period – Determination of rigidity modulus by Torsional oscillation (without masses).

Viscosity: Viscosity of a liquid – Viscous force – Co-efficient of viscosity of a liquid – Poiseuille's formula .

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

UNIT – II: HEAT

Heat: Specific heat – Newton's law of cooling – determination of specific heat of a liquid using Newton's law of cooling – Emissivity and Emissive Power.
Low Temperature: J.K. Effect – Positive Effect – Negative Effect – Temperature of Inversion – Super conductors. Type I and II – Meisner Effect – Helium I and II.

UNIT – III: ELECTRICITY AND MAGNETISM

Electricity: Potentiometer – Principle – Calibration of low range voltmeter – Measurement of internal resistance of cell – measurement of an unknown resistance.

Magnetism – Moment and pole strength of a magnet – Deflection magnetometer – Tan C position – Vibration magnetometer – Theory – Period of Oscillation – Determination of M and B_H using the deflection magnetometer in Tan C position and the vibration magnetometer.

UNIT – IV: SOUND AND ACOUSTICS OF BUILDING

Sound: Transverse vibration of strings – Velocity and frequency of vibrations of a stretched string – laws – sonometer – A.C. Frequency – Steel Wire – Brass wire.

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.

Diffraction: Theory of transmission grating – Normal Incidence – Determination of Wavelength of monochromatic source and Wavelength of mercury line using a grating by normal Incidence.

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

Books for Study & Reference

9. Allied Physics – R. Murugesan S. Chand & Co. First Edition (2005).
10. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
11. Allied Physics – Prof. Dhanalakshmi and others.
12. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
13. Heat and Thermodynamics – N. Brijlal and Subramaniam S. Chand & Co.
14. A text book of Sound – by M. Narayanamoorthy and other National Publishing Companies (1986).
15. Modern Physics – R. Murugesan S. Chand & Co. (2004).
16. Introduction to Fibre optics- K.Thyagarajan and Ajay Ghatak,Cambridge,University Press(1999).

ALLIED

3.ZOOLOGY I

Objective:

To acquire knownledge about different kinds of animal species.

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

UNIT – I:
Type study includes life history.

Protozoa - Entamoeba, **Porifera** - Sycon. **Coelenterata** - Obelia geniculata. **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.

Chordata - Genaral charters, **Prochordata:** Morphology of Amphioxus. **Vertebrates: Pisces** - Shark.

UNIT - IV

Amphibia: Frog, **Reptiles:** Calotes

UNIT - V

Aves: Pigeon, **Mammalia:** Rabbit.

REFERENCES:

1. Ayyar, E.K. and T.N. Ananthakrishnan. 1992. Manual of Zoology. Vol I & II, S. Viswanathan (printers and publishers) Pvt. Ltd., Madras, 891 p.

2. Kotpal series, 1998 - 1992. Rastogi Publications, Meerut.

3. Jordan E.L. and P.S. Verma. 1993. Invertebrate Zoology 12th edition, S. Chand & Co., Ltd., New Delhi.

4. Jordan, E.L., and P.S. Verma. 1995. Chordate Zoology and Elements of Animal Physiology, S. Chand & Co., Ltd., New Delhi.

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.
2. Harper's Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, and Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
6. Biomolecules-C. Kannan , MJP Publishers, Chennai - 5.

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 $\sin^n \theta$, $\cos^n \theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ - Expansions of $\sin \theta$, $\cos \theta$, $\tan \theta$ in terms of θ.

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:

P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics,* Vol. I & II.Muhil Publishers, Chennai.

Reference Books:

6. P.Balasubramanian and K.G.Subramanian,(1997) *Ancillary Mathematics.* Vol. I & II. Tata McGraw Hill, New Delhi.
7. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II. VikasPublications, New Delhi.
8. P.R.Vittal (2003) *Allied Mathematics* .Marghan Publications, Chennai
9. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand& company Ltd., New Delhi-55.
10. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai.

SKILL BASED SUBJECT

PAPER – 1

WATER TREATMENT AND ANALYSIS

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

4.1 Water analysis - Sampling of Water for analysis - Chemical Substances affecting Potability - Colour, Turbidity, Odour, Taste, Temperature, pH and Electrical Conductivity.

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

1. Industrial Chemistry (Including Chemical - Engineering) - B. K. Sharma - Goel Publishing House, Meerut (1987).

2. Pollution Control in Process Industries - S. P. Mahajan - Tata McGraw Hill Publishing Company Ltd., New Delhi (1991).

3. Water Pollution and Management - C. K. Varashney - Wiley Eastern Ltd., Chennai -20 (1991).

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.

5.3 Asbestos, Silica, Lead Paints, Cement, Welding fumes and Gases - Hazard alert and Precautions for Safety.

Reference Books

1. Applied Chemistry, Jayashree Ghosh - S. Chand and Company Ltd., 2006

2. Biochemistry, S. C. Rastogi - Tata McGraw Hill Publishing Co., 1993.

3. Medicinal Plants of India, Rasheeduz Zafar - CBS Publishers and Distributors, 2000.

4. Hawk's Physiological Chemistry, B. L. Oser - Tata-McGraw Hill Publishing Co. Ltd.

5. Practical Pharmaceutical Chemistry, A. H. Beckett and J. B. Stenlake - Vol. I - CBS Publishers and Distributors, 2000.

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 XeF_2, XeF_4, XeF_6 and $XeOF_4$ (Preparation, Properties – Not necessary).

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

UNIT-II

2.1 Monocarboxylic acids – Acetic acid and Benzoic acid – Preparation by Grignard method – Conversion of Acids to their derivatives – Amide, Ester, Anhydride and Acid Chloride – Strength of Carboxylic Acids – Effect of Substituents on the Strength of Acids.

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

2.3 Amines – Ethylamine and Aniline – Preparation – Basicity of Amines – Effect of Substituents on Basicity - Reactivity of Amines – Distinction between Primary, Secondary and Tertiary Amines.

UNIT-III

3.1 Alcohols – Preparation by Grignard method – Oxidation of alcohols – Difference between Primary, Secondary and Tertiary alcohols – Preparation and Properties of Allyl alcohol.

3.2 Phenols - Acidic character of phenols - Kolbe's reaction, Reimer-Tiemann reaction, Gattermann , Lederer-Manasse, Houben-Hoesh, Friedel-Crafts, Schotten-Baumann and Liebermann's Nitroso Reaction.

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

5.1 Third Law of Thermodynamics - Entropy at Absolute Zero - Nernst Heat Theorem – Statement of III law of thermodynamics – Planck's formulation of III law of thermodynamics.

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

- Vogel's Text Book of Quantitative Chemical Analysis, 5th Edition, ELBS/ Longman, England, 1989.
- Inorganic Semimicro Qualitative Analysis, V. V. Ramanujam.

ALLIED – 4

1.PHYSICS II

UNIT – I: WAVE MECHANICS

Wave Mechanics – De Broglie Waves – Dual Nature – Experimental Study of Matter Waves – Davission and Germer's Experiment – G.P. Thomson's Experiment _ Heisenberg's uncertainty Principle – The position and moment of a particle.

UNIT – II : NUCLEAR PHYSICS

Particle accelerators – cyclotron, particle detectors – GM Counter Artificial Transmutation – Rutherford's Experiment – The Q value equation for nuclear reaction – Threshold energy – Nuclear Reactions.

Conservation Laws: Conservation of Charge – Conservation of Nucleons – Conservation of Mass – Energy – Conservation of Parity – Quantities conserved and quantities not conserved in a nuclear reaction.

UNIT – III : ENERGY PHYSICS

Sources of conventional energy – Need for non-conventional energy resources – solar energy utilization – solar water heater – solar drier – conversion of light into electrical energy – solar cell – merits and demerits of solar energy – wind energy – its conversion systems – energy from Bio mass – Bio gas generation – Industrial and space application.

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

11. Allied Physics – R. Murugesan S. Chand & Co. First Edition (2005).
12. Allied Physics – Dr. K. Thangaraj, Dr. D. Jayaraman Popular Book Department, Chennai.
13. Allied Physics – Prof. Dhanalakshmi and others.
14. Elements of Properties of Matter – D.S. Mathur, S. Chand & Co. (1999).
15. Heat and Thermodynamics – N. Brijlal and Subramaniam S. Chand & Co.
16. A text book of Sound – by M. Narayanamoorthy and other National Publishing Companies (1986).
17. Modern Physics – R. Murugesan S. Chand & Co. (2004).
18. Electronic Principles and Applications – A.B. Bhattacharya, New Central Book Agency, Calcutta.
19. Introduction to Solid State Physics – C. Kittel, 5^{th} Edition Wiley Eastern Ltd.
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

Cell Biology - structure of animal cell, **Genetics:** molecular structure of gene - gene function, sex linked inheritance. Genetic Engineering and its application.

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

Environmental Biology - Biotic factors and Abiotic factors, food chain and food web. Pollution - Environmental degradation, (Air, Water and Land) - Green house effect - Bioremediation, Biodegradation - Global warming - acid rain.

UNIT - V

Evolution: Theories of Lamarkism & Darwinism.

REFERENCES:

7. Ekambaranatha Ayyar, and Ananthakrishnan, T.N. 1993. Outlines of Zoology, Vol I & II, Viswanathan and Co, Madras.
8. Sambasiviah, I, Kamalakara Rao, A.P., Augustine Chellappa, S. 1983. Text book of Animal Physiology, S. Chand & Co., New Delhi.
9. Verma and Agarwal. 1983. Text book of animal Ecology, S. Chand & Co., New Delhi.
10. Verma and Agarwal and Tyagi. 1991. Chordate Embryology, S. Chand & Co., New Delhi.
11. Rastogi and Jayaraj. 2000. Text book of Genetics. Rastogi publications, Meerut.
12. Verma and Agarwal. 2000. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Co., New Delhi.

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

Definition, classification of enzymes with one example. Mechanism of enzyme action - Lock and key mechanism, Induced Fit theory. Michaleis-Menton equation. Enzyme inhibition: competitive, uncompetitive and non competitive. Biological functions of enzymes.

UNIT-IV: Molecular Biology

Central dogma of molecular biology. DNA and RNA act as genetic material. Replication: Definition, types, mode of action of replication, mechanism of replication. General mechanism of transcription and translation. Genetic code.

UNIT-V: Vitamins

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

References:

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan worth Publishers.
2. Harper's Biochemistry-Robert K. Murray, Daryl K. Grammer, McGraw Hill, and Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
6. Biomolecules-C. Kannan, MJP Publishers, Chennai-5.

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

P.Duraipandian and S.Udayabaskaran,(1997) *Allied Mathematics*, Vol. I & II.Muhil Publishers, Chennai

Reference Books:

6. P.Balasubramanian and K.G.Subramanian,(1997)*Ancillary Mathematics*. Vol. I & II. Tata McGraw Hill, New Delhi.
7. S.P.Rajagopalan and R.Sattanathan,(2005) *Allied Mathematics* .Vol. I & II.Vikas Publications, New Delhi.
8. P.R.Vittal(2003). *Allied Mathematics* .Marghan Publications, Chennai.
9. P.Kandasamy, K.Thilagavathy (2003) Allied Mathematics Vol-I, II S.Chand& company Ltd., New Delhi-55.
10. Isaac, Allied Mathematics. New Gamma Publishing House, Palayamkottai

ALLIED PRACTICAL - 2

1.PHYSICS

(Any 15 Experiments)

21. Young's modulus – non uniform bending – pin and microscope.
22. Rigidity modulus – Static Torsion Method Using Scale and Telescope.
23. Ridigity modulus – Torsional oscillation method (without symmetric masses).
24. Determination of Co-efficient of Viscosity – Graduated Burette.
25. Surface Tension and Interfacial Tension – By drop weight method.
26. Specific Heat Capacity of a liquid – by Newton's Law of Cooling.
27. Sonometer – Determining A.C. Frequency. (Screw Gauge is given).
28. Sonometer – frequency of tuning fork.
29. Newton's Rings – Radius of Curvature.
30. Air Wedge – Determination of thickness of thin wire.
31. Spectrometer Grating – Minimum Deviation – Mercury Lines.
32. Spectrometer – Refractive Index of a liquid – Hollow Prism.
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.

Allied Practical
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.

Sphygnomanometer, Stethoscope, Rain gauge.

REFERENCES:

3. Verma. P.S. 2011. A manual of practical Zoology - INVERTEBRATES. Chand & Co., Ltd., Ram Nagar, New Delhi.

4. Verma. P.S. 2011. A manual of practical Zoology - CHORDATES. Chand & Co., Ltd., Ram Nagar, New Delhi.

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.

5.3 Food Colours – Restricted use – Spurious Colours – Taste Enhancers – MSG – Vinegar.

Reference Books

- Food Science – B. Srilakshmi, III Edition, New Age International Publishers, 2005.
- Food Chemistry - Lilian Hoagland Meyer, CBS Publishers & Distributors, 2004.
- Food Science, Nutrition and Health – Brian A. Fox, Allan G. Cameron, Edward Arnold, London.
- Fundamentals of Foods and Nutrition - Mudambi R. Sumathi, and Rajagopal, M. V., - Wiley Eastern Ltd., Madras.
- Handbook of Food and Nutrition - M. Swaminathan - Bangalore Printing and Publishing Co. Ltd., Bangalore.

NON – MAJOR ELECTIVE

PAPER – 2

CHEMISTRY IN EVERY DAY LIFE

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

3.1Food 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

1. Chemical Process Industries - Norris Shreve Joseph A. Brine .Jr.
2. Perfumes, Cosmetics and Soaps - W. A. Poucher (Vol 3).
3. Environmental Chemistry - A. K. DE.
4. Industrial Chemistry, B. K. Sharma- Goel publishing house Meerut.
5. Food Science - B. Srilakshmi - III Edition - New Age International Publishers, 2005.
6. Food Chemistry, Lillian Hoagland Meyer - CBS publishers & distributors, 2004.
7. Fundamental Concepts of Applied Chemistry - Jayashree Ghosh, S. Chand & Co

Ltd., New Delhi – 2010.

8. Applied chemistry - K. Bagavathi Sundari - MJP Publishers (2006).

SEMESTER – V
PAPER – 5
INORGANIC CHEMISTRY – I

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, AX_3, AX_5 and AX_7 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.

PAPER – 6

ORGANIC CHEMISTRY – I

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

1.1 Carbohydrates - Classification – Aldoses and Ketoses, Reducing and Non-reducing Sugars - Reactions of Glucose and Fructose - Osazone formation, Mutarotation and their Mechanism - Structural elucidation of Glucose and Fructose - Pyranose and Furanose forms – Haworth's method.

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

of optical isomers - Cahn - Ingold - Prelog rules - R, S notation of Optical isomers with one Asymmetric carbon atoms – Erythro and Threo representations.

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.

2.3 Geometrical isomerism - Cis - Trans, Syn - Anti and E-Z Notations - Geometrical Isomerism In Maleic and Fumaric Acids and Unsymmetrical Ketoximes - Methods of Distinguishing Geometrical Isomers using Melting Points, Dipole Moment, Dehydration, Cyclisation, Heat of Hydrogenation and Combustion.

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

4.1 Nitroalkanes – Preparation – Properties – Structure – Nitro-Acinitro Tautomerism – Uses of Nitroalkanes – Differences between Primary, Secondary and Tertiary Nitroalkanes.

4.2 Reagents and their Applications in Organic Chemistry – Anhydrous $AlCl_3$, P_2O_5, H_2/ Pd- $BaSO_4$, Zn/ Hg- HCl and Ag_2O.

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

1.1 Solutions of liquids in liquids - Raoult's law – Vapour pressure of ideal solutions – Activity of a component in an ideal solution – Gibbs-Duhem-Margules equation – Thermodynamics of Ideal Solutions.

1.2 Vapour pressure of Non-ideal solutions – Fractional distillation of Binary liquid solutions – Azeotropic mixtures - Distillation of immiscible liquids - Partially miscible liquids - Phenol - Water, Triethylamine – Water and Nicotine – Water systems.

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, $FeCl_3$- 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.

3.2 Chemical Equilibrium - Law of Chemical Equilibrium - Thermodynamic derivation of Law of Chemical Equilibrium.

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.

1.3. Purification of Solid Organic Compounds – Solvent extraction – Recrystalisation - Use of immiscible solvents – Soxhlet extraction – Crystallisation – Use of miscible solvents – Fractional Crystallisation and Sublimation.

UNIT – II

2.1 Purification of liquids – Experimental Techniques of Distillation – Fractional Distillation – Vacuum Distillation – Steam Distillation – Tests of Purity.

2.2 Gravimetric Analysis – Characteristics of Precipitating Agents – Condition of Precipitation – Types of Precipitants – Purity of Precipitate – Co-precipitation and Post precipitation – Precipitation from Homogeneous Solution – Digestion and Washing of precipitate – Ignition of precipitate – Uses of Sequestering Agents.

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**

3.1 Microwave Spectroscopy – Theory of Microwave Spectroscopy – Selection Rule – Calculation of Moment of Inertia and Bond Lengths of Diatomic molecules – Effect of Isotopic Substitution.

3.2 UV – Visible Spectroscopy – Absorption laws - Calculations involving Beer- Lambert's law – Instrumentation – Photocalorimeter and Spectrophotometer – Block diagrams with description of components – Theory of Electronic Spectroscopy.

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

4.1 IR Spectroscopy – Principle – Theory of IR spectra – Vibrational Degrees of Freedom - Modes of Vibration of Diatomic Molecules –Triatomic linear (CO_2) and Non-linear Molecules (H_2O) - Stretching and Bending vibrations – Symmetric and Asymmetric Stretching vibrations - Selection rules.

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.

4.3 Applications of IR Spectroscopy – Identification of Functional Groups - Interpretation of the spectra of Alcohols, Aldehydes, Ketones and Esters (Aliphatic and Aromatic) - Hydrogen bonding.

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.

5.2 Raman Spectrophotometer - Instrumentation – Block diagram – Components and their Functions – Advantages of using Laser in Raman Spectroscopy – Applications – Structural elucidation in the study of Inorganic and Organic Compounds.

5.3 Rotational-Raman spectra of Non - Centrosymmetric molecules - Mutual exclusion principle (CO_2 and N_2O) - Applications – Structural diagnosis.

Reference Books

- Elements of Analytical Chemistry – R. Gopalan, P. S. Subramanian, K. Rengarajan – S. Chand and sons (1997).
- Fundamentals of Analytical Chemistry – D. A. Skoog and D. M. West, Holt Reinhard and Winstor Publications – IV Edition (1982).
- Principles of Instrumental Methods of Analysis – D. A. Skoog and Saunders, College Publications, III Edition (1985).
- Analytical Chemistry – S. M. Khopkar – New age Insternational Publishers.
- Instrumental Methods of Chemical Analysis – Chatwal - Anand, Himalaya Publishing House (2000).
- Analytical Chemistry – R. Gopalan, Sultan Chand.
- Analytical Chemistry – S. Usharani, Macmillan.
- Instrumental Methods of Analysis – 7^{th} Edition – H. H. Willard, L. L. Merit. J. Dean and F. A. Settle –Wadsworth Publishing Company Limited, Belmont, California, USA, 1988.
- Physico- Chemical Techniques of Analysis – P. B. Janarthanan – Vol. I & II – Asian Publishing.
- Instrumental Methods of Chemical Analysis – B. K. Sharma – Goel Publications.
- Applications of Absorption Spectroscopy of Organic Compounds - Prentice Hall, John R. Dyer.
- Spectroscopic Identification of Organic Compounds – R. M. Silverstein, G. C. Bassler and T. C. Morill – John Wiley and Sons.

PAPER – 1

B. BASICS OF COMPUTER PROGRAMMING IN C AND ITS APPLICATIONS IN CHEMISTRY

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.
1.3 Planning the Computer Program – Algorithm and Flowcharts - Basics of Operating Systems.

Unit-II

2.1 Computer Languages – Machine Language, Assembly Language, Assembler, Compiler, Interpreter and Programming Languages.
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

- Computers in Chemistry, K. V. Raman, 8th Edition, Tata McGraw Hill Publishers, 2005.
- Programming with C, Venugopal and Prasad, 11th Edition, 1971. .
- Programming in C, E. Balaguruswamy, 2nd Edition, 1989.

PAPER – 1

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

- Some Modern Methods of Organic Synthesis, W. Carruthers, Cambridge University Press, UK.
- Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Part- B, Plenium Press.
- 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.

2.2 Blood - Composition of Blood and Blood Plasma – RBC – Structure and Functions - Functions of Haemoglobin – WBC - Structure and Functions - Rh Factor – Blood Coagulation – Identification and Estimation of Cholesterol in Blood - Blood Pressure – Hypertension and Hypotension - Normal, High and Low to Control.

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

UNIT-III

3.1 Antibacterials - Sulpha drugs – Sulphanilamide Derivatives – Mode of action of Sulpha drugs - Examples - Prontosil, Sulphathiazole and Sulphafurazole – Uses - Antibiotics - Definition – Gram positive and Gram negative bacteria - Uses of Ampicillin, Streptomycin and Tetracyclines.

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.

4.2 Anaesthetics – Definition – Classification - Local and General – Volatile – Uses of volatile liquids as Inhalation Anaesthetics – Chloroform - Gaseous Anaesthetics - Nitrous Oxide, Ether and Cyclopropane - Uses and Disadvantages – Intravenous Anaesthetic Agents – Thiopental sodium, Methohexitol and Propanidid.

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

1. A Text Book of Pharmaceutical Chemistry - Jayashree Ghosh - S. Chand Company Ltd, 2015.
2. Pharmaceutical Chemistry - S. Lakshmi - Sultan Chand, 2011.
3. Pharmacology and Pharmatherapeutics - R. S. Satoskar - Popular Prakashan - Vol.I and Vol. II.
4. Medicinal Chemistry - Asuthosh Kar - New Age International Publishers, 2007.
5. A Text Book of Synthetic Drugs - O. D. Tyagi - Ammol Publications.
6. Introduction to Biological Chemistry - J. Awapara, Prentice Hall.
7. A Text Book of Biochemistry - Ambika.S.
8. Biochemistry - A. L. Leninger, II Edition, Kalyani Publishers, Ludhiana, 1998.
9. Essentials of Biological Chemistry - James Fanley - East West Press.
10. Medicinal Chemistry - Gurdeep Chatwal – Himalaya Publishers House, 2012.
11. Medicinal Chemistry - Ahluwalia – Ane Books, 2008.
12. A Text Book of Pharmaceutical Chemistry – Viva Books Private Ltd., New Delhi, 2009.
13. Medicinal Plants of India – Rasheeduz Zafar – CBS Publishers and Distributors, 2000.

ELECTIVE

PAPER – 2

B. POLYMER CHEMISTRY

Objective:

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

UNIT-I

1.1 Introduction to Polymers – Monomers, Oligomers, Polymers and their Characteristics - Classification of Polymers – Addition and Condensation Polymers – Natural and synthetic – Linear, Branched, Cross-Linked and Network – Plastics – Elastomers – Fibres – Homopolymers and Copolymers.

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.

2.3 Reactions – Hydrolysis – Hydrogenation –Addition – Substitution –Cross linking – Vulcanisation – Cyclisation.

UNIT-III

3.1 Plastics and Resins – Definitions – Thermoplastic and Thermosetting Resins – Constituents of Plastic Fibres – Dyes, Pigments, Plasticisers, Lubricants and Catalysts.

3.2 Important Thermoplastic Resins – Acrylics, Polyvinyl and Cellulose Derivatives - Important Thermosetting Resins – Phenolic resins – Epoxy resins.

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.

4.2 Textile fibres – Definition and Polymer requirement for fibres – Polyamides – Nylon 66 - Nylon 6 – Polyesters – Terylene – Cellulose acetate – Viscose rayon.

4.3 Natural and Synthetic Rubber – Constitution of Natural rubber – Natural Rubber – Isoprene – Synthetic Rubber - Butyl, Buna, Buna- S, SBR, Thiocol, Neoprene, Polyurethane and Silicone Rubber – Ebonite.

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,

Polyparaphenylene, Polypyrrole, Polythiophene, Polyaniline and Polyacetylene.

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

Reference Books

1. Text Book of Polymer Science, F. W. Bill Meyer, Jr. John, Wiley & Sons - 1984.
2. Polymer Science – V, R. Gowarikar, N. V. Viswanathan, Jayader Sreedhar - Wiley Eastern Ltd., New Delhi - 2005
3. Polymer Chemistry, B. K. Sharma - Goel Publishing House, Meerut - 1989.
5. Polymer Chemistry – M. G. Arora, M. S. Vadar - Anmol Publications (p) Ltd., New Delhi -1998.
6. Polymer Chemistry - An introduction - M. P. Stevens, Oxford - 2002.

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

1.1 Need for Green Chemistry – Principles of Green Chemistry – Atom economy – Definition with example (Ibuprofen synthesis) – Green oxidants – Hydrogen peroxide.

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 CO_2 – 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

4.1 Green Catalysis - Heterogeneous catalysis – Uses of Zeolites, Silica, Alumina, Clay supported catalysis – Biocatalysis – Enzymes and Microbes.

4.2 Phase Transfer Catalysis (PTC) – Principles, Catalysts and Lipophility of ions – Two phase systems – Solid-Liquid, Liquid-Liquid, Gas-Liquid – Triphase systems – Inverted PTC – Applications in Synthesis.

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

- Green Chemistry: Environmental Friendly Alternatives, Rs. Sanghi and M. M. Srinivatava, Narosa Publishing House, New Delhi.
- Green Chemistry, V. Ahluwalia, Narosa, New Delhi (2011).
- Nanotechnology, S. Shanmugam, MJP Publishers, Chennai. (2010).
- A Handbook on Nanochemistry, Patrick Salomon, Dominant Publishers and Distributers, New Delhi.
- Nanobiotechnology, S. Balaji, MJP Publishers, Chennai (2010).
- Nano: The Essentials, T. Pradeep, Tata Mc-Graw Hill, New Delhi (2007).

Books for Reference

- Methods and Reagents for Green Chemistry, P. Tundo, A. Perosa and F. Zechini, John Wiley & Sons Inc., New Jercy, (2007).
- The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Vol. I and II, CNR Rao, Springer (2006).
- Nanotechnology: Basic Science and Emerging Technologies, Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press (2005).
- Nanochemistry, G. B. Segreev, Elsevier, Science, New York, (2006)

SKILL BASED SUBJECT

PAPER – 3

APPLIED CHEMISTRY

Objective:

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

UNIT I

1.1 Petroleum - Origin – Composition of Petroleum - Inorganic, Engler and Modern theories – Classification – Refining (Simple Refinery) – Cracking – Thermal and Catalytic – Knocking – Octane Rating – Antiknock Compounds – Cetane Rating – Synthetic Petrol – LPG.

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

1.3 Petrochemicals – Elementary study – Definition - Chemicals from Natural Gas, Petroleum, Light naphtha and Kerosene – Origin – Composition - Synthetic Gasoline.

UNIT II

2.1 Paper technology – Introduction – Manufacture of pulp – Various raw materials used for the preparation of pulp - Preparation of Sulphite pulp, Soda pulp and Rag pulp.

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.

3.2 Recovery of Glucose from Molasses – Defection – Sulphitation – Carbonation – Testing and Estimation of Sugar – Double Sulphitation Process.

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

4.1 Explosives – Primary, Low and High Explosives – Single compound explosives - Binary explosives – Plastic explosives – Dynamites – Blasting explosives - Preparation and Uses of Lead Azide, Nitroglycerine, Nitrocellulose, TNT, Cordite, Picric Acid and Gun Powder – Introduction to Rocket Propellants.

4.2 Photography – Chemical Principle – Preparation of Sensitive Emulsion – Exposure – Developing – Fixing and Printing – Colour photography – Xerographic copying.

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

1. Fundamental Concepts of Applied Chemistry - Jayashree Ghosh - 1st Edition, S. Chand & Co. Ltd, New Delhi, 2006.
2. Milk and Milk Products - Clarence Henry Eckles, Willes Barnes Combs, Harold Macy - 4th Edition, Tata McGraw Hill Publishing Company Ltd, Reprint 2002.
3. Industrial Chemistry - B. K. Sharma - 13th Edition, Goel Publishing House, 2008.

SEMESTER – VI
PAPER – 8
INORGANIC CHEMISTRY – II

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

1.3 Nuclear Binding Energy - Mass defect - Simple calculations involving Mass Defect and Binding Energy per Nucleon - Magic Numbers – Liquid drop model - Shell model.

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

3.1 General metallurgy and Metallurgical processes – Methods of Concentration – Gravity separation, Froth floatation process, Magnetic separation – Reduction methods – Smelting, Calcination, Goldschmidt Aluminothermic process - Purification methods – Zone refining, Van Arkel method and Electrolytic refining.

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 Ocurrence and Extraction of Ti, Mo, W and Co - Preparation and Uses of Ammonium Molybdate and $V_2 O_5$.

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 – Positon 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

- Qualitative Inorganic Analysis, A.I. Vogel – 7th Edition, Prentice Hall.
- Quantitative Chemical Analysis, A.I. Vogel – 6th Edition, Prentice Hall.

PAPER - 9

ORGANIC CHEMISTRY – II

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 – Anionotrpic, 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.

2.3 Peptides - Synthesis - Bergmann Method - Structural Determination of Polypeptides - End Group Analysis – N-Terminal and C-Terminal Amino Acids Determination.

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.

5.3 Grignard Reagents – Preparation – Synthetic Applications – Diazomethane – Preparation by Von-Pechmann method – Synthetic Applications.

CORE PRACTICAL

PAPER – 4

ORGANIC QUALITATIVE ANALYSIS AND PREPARATIONS

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.
- Text Book of Practical Organic Chemistry – A. I. Vogel, A. R. Tatchell, B. S. Furnis, A. J. Hannaford and P.W. G. Smith – 5^{th} Edition - 1996.
- Comprehensive Practical Organic Chemistry - Preparation and Quantitative Analysis - V. K. Ahluwalia, Renu Agarwal – Universities Press – 2013.

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

1.1 Galvanic cells - Daniel cell - Reversible and Irreversible Cells – EMF of a Cell and its Measurement - Standard Weston Cadmium Cell – Evaluation of Thermodynamic Quantities.

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

1.3 Reference electrodes - Standard Hydrogen Electrode - Standard Electrode Potential - Sign conventions - Electrochemical Series and its Applications.

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.

2.3 Polarisation - Overvoltage – Storage Cells - Decomposition potential - Lead Storage Battery - Fuel Cells (H_2-O_2 Cell) - Mechanism of Discharging and Recharging Fuel Cells.

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

4.1 Adsorption – Characteristics of adsorption – Physisorption and Chemisorption – Differences between Physical and Chemical Adsorption - Applications of Adsorption – Adsorption of Gases by Solids – Different Types of Isotherms - Freundlich adsorption isotherm - Langmuir theory of adsorption – Derivation.

4.2 Catalysis – Definition - General Characteristics of Catalytic Reactions – Acid-Base catalysis – Enzyme catalysis – Michaelis-Menton Equation – Effect of Temperature and pH on Enzyme Catalysis.

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 - H_2-Cl_2 and H_2-Br_2 reactions - Photodimerisation of Anthracene

REFERENCE BOOKS

INORGANIC CHEMISTRY

1. Inorganic Chemistry – P. L. Soni - Sultan Chand (2006).
2. Principles of Inorganic Chemistry - B. R. Puri, L. R. Sharma and K. C. Kallia – Milestone Publications (2013).
3. Selected Topics in Inorganic Chemistry - W. U. Malik, G. D. Tuli and R. D. Madan - S. Chand Publications (2008).
4. Inorganic Chemistry: Principles of Structure and Reactivity - J. E. Huheey, E. A. Keiter, R. I. Keiter and O. K. Medhi – 2006.
5. Concise Inorganic Chemistry - J. D. Lee - III edition - Von Nostrand.
6. Industrial Chemistry - B. K. Sharma - Goel Publications (1983).
7. Industrial Chemistry R. K. Das - Kalyani Publications, New Delhi (1982).
8. Coordination Chemistry - S. F. A. Kettle - ELBS (1973).
9. Coordination Chemistry - K. Burger - Butterworthy (1973).
10. Vogel's Handbook of Quantitative Inorganic Analysis - Longman.
11. Text Book of Qualitative Inorganic Analysis - A. I. Vogel - III edition (1976).
12. Source Book on Atomic Energy – S. Glasstone- East-West Press Pvt. Ltd. (1967).
13. Nuclear and Radiochemistry - John Wiley and Sons (1964).
14. Nuclear Chemistry - H. J. Arnikar - Wiley Eastern Co., - II edition (1987).
15. Advanced Inorganic Chemistry - Cotton and Wilkinson - V Edition - Wiley and Sons (1988).
16. Text Book of Inorganic Chemistry – R. Gopalan – Universities Press – 2012.
17. Modern Inorganic Chemistry – R. D. Madan - S. Chand Publications, Reprint, 2014.

ORGANIC CHEMISTRY

1. Organic Chemistry - R. T. Morrison and Boyd – Pearson – 2010.
2. Organic Chemistry - I. L. Finar - Volume I and II - Pearson Education.
3. Text Book of Organic Chemistry - P. L. Soni - Sultan Chand & Sons - 2007.
4. Advanced Organic Chemistry - Bahl and Arun Bahl - S. Chand and Co. Ltd. – 2012.

5. Stereochemistry, Conformations and Mechanisms - Kalsi – 2nd Edition, Wiley Eastern Ltd., Chennai – 1993.
6. Organic Chemistry of Natural Products - Volume I and II - O. P. Agarwal - Goel Publishing House
7. A Guide Book to Mechanisms in Organic Chemistry - Peter Sykes - Pearson Education - 2006.
8. Stereochemistry of Organic Compounds - D. Nasipuri - New Age International Publishers..
9. Chemistry of Natural Products - Gurdeep Chatwal- Himalaya Publishing House.
10. Reactions and Reagents - O. P. Agarwal- Goel Publishing House.
11. Organic Reaction Mechanisms - Gurdeep Chatwal- Himalaya Publishing House.
12. A Text Book of Organic Chemistry, K. S. Tewari, N. K. Vishnoi, S. N. Mehrotra - Vikas Publishing House - 2011.
13. Modern Organic Chemistry- M. K. Jain and S. C. Sharma- Vishnoi Publications, 2014.
14. Reaction, Mechanism and Structure - Jerry March - John Wiley and Sons, NY -1992.
15. Organic Chemistry - Bruice - Pearson Education.
16. Text Book of Organic Chemistry – C. N. Pillai – Universities Press – 2009.
17. Organic Reaction Mechanisms - Parmar and Chawla – S. Chand & Co.
18. Organic Chemistry – I. L. Finar - 6th Edition, Pearson Education, 2008.
19. A Guide Book to Mechanisms in Organic Chemistry – Peter Sykes - Pearson Education, 2006
20. Stereochemistry of Carbon Compounds- E. I. Eliel – Tata Mcgrow Hill Education – 2000.
21. Organic Chemistry - T. W. Graham Solomon, C. B. Fryhle – S. A. Dnyder – John Wiley & Sons – 2014.
22. Advanced Organic Reaction Mechanism (Problems and Solutions) – N. Tewari – Books and Allied (P) Ltd – 2005.
23. Advanced Organic Stereochemistry (Problems and Solutions) – N Tewari - Books and Allied (P) Ltd – 2010.

PHYSICAL CHEMISTRY

1. Principles of Physical Chemistry - B. R. Puri, Sharma and Madan S. Pathania, Vishnal Publishing Co., - 2013.
2. Text Book of Physical Chemistry - P. L. Soni, O. P. Dharmarha and U. N Dash - Sultan Chand & Co., – 2006.
3. Physical Chemistry - Negi and Anand – Eastern Wiley Pvt.Ltd..
4. Physical Chemistry - Kundu and Jain - S. Chand & Co.
5. Physical Chemistry - K. L. Kapoor - Macmillan - 4 volumes.
6. Elements of Physical Chemistry - Glasstone and Lewis - Macmillan.
7. Text book of Physical Chemistry - S. Glasstone - Macmillan (India) Ltd.
8. Fundamentals of Physical Chemistry - Maron and Landor - Colier - Macmillan.
9. Physical Chemistry - G. W. Castellan - Narosa publishing house - 2004.
10. Physical Chemistry - Walter J. Moore - Orient Longman – 1972.
11. Numerical Problems on Physical Chemistry, Gashal - Books and Allied (P) Ltd.,
12. Universal General Chemistry, C.N.R. Rao, Macmillan.
13. Group Theory and its Chemical Applications - P. K. Bhattacharya - Himalaya Publishing House.
14. Text book of Physical Chemistry – M. V. Sangaranarayanan, V. Mahadevan, Universities Press - 2011.
15. General and Physical Chemistry – Dr. A. Arunabhasan, Books of Allied (P) Ltd., - Ghosal – 2009.

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. $Na_2S_2O_3.5H_2O$, $CH_3COONa.3H_2O$, $SrCl_2.6H_2O$, $MnCl_2.4H_2O$

5. **Electrochemistry**

Conductivity

a) Determination of Cell Constant and Equivalent Conductivities ofthe 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.

7. Colorimetry- Determination of unknown concentration using Photoelectric colorimeter.

8. Determination of pKa of acetic acid using pH Meter.

***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

1.1Chromatography – Principles and Techniques of Column, Paper and Thin Layer Chromatography – Column Chromatography – Preparation of Column - Adsorption - Adsorbents – Elution – Recovery of Substances.

1.2 TLC - Choice of Adsorbent and Solvents – Preparation of Chromatogram and Applications - R_f value - Paper Chromatography – Solvents used – Factors affecting R_f value – Separation of Amino Acid Mixtures – Radial Paper Chromatography - Applications.

1.3 lon exchange chromatography – Principle – Experimental Techniques – Types of Resins – Reqirement of a Good Resin – Action of Ion Exchange Resins – Experimental Techniques and Applications – Separation of Zinc- Magnesium, Cobalt - Nickel and Cadmium - Zinc ions.

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 Coulpling 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

5.1 ESR Spectroscopy – Condition – Selection Rule for Transition - Theory of ESR Spectra – Basic Instrumentation - ESR Spectrometer – Components and their Functions - Hyperfine splitting – ESR Spectra of simple radicals – CH_3, CD_3, Naphthalene radical ions only – Applications in structural elucidation.

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 ($CaC_2O_4.H_2O$, $CuSO_4.5H_2O$) and DTA curves – Factors Affecting TGA and DTA Curves – Thermometric Titrations – Principle and Applications.

Reference Books

1. Analytical Chemistry – S. M. Khopkar – New Age International Publishers – 1998.
2. Analytical Chemistry – R. Gopalan – Sultan Chand & Sons – 2002.
3. Chemical Analysis: An Instrumental Approach – A. K. Srivastava and P. C. Jain.
4. Spectroscopic Identification of Organic Compounds – R. M. Silverstein, G. C. Basseler & T. C. Morill.
5. Organic Spectroscopy – W. Kemp.
6. Spectroscopic Methods in Organic Chemistry – D. Williams & I. Fleming.
7. Fundamentals of Moleculars Spectroscopy – 4th Edition, C. N. Banwell and E. M. McCash – Tata McGrow Hill Publishers, New Delhi - 2006.
8. Applications of Absorption Spectroscopy of Organic Compounds – John R. Dyer.
9. Introduction to Molecular Spectroscopy – Barrow.
10. Spectroscopy of Orgnic Compounds - P. S. Kalsi.
11. Instrumental Methods of Chemical Analysis – B. K. Sharma – Goel Publications – 2000.
12. Fundamentals of Analytical Chemistry: An introduction – D. A. Skoog, D. M. West – Thomson – 2004.
13. Analytical Chemistry: Theory and Practice – U. N. Dash.
14. Vibrational Spectroscopy - D. N. Sathyanarayanan – New Age International Publishers – 2000.
15. Fundamentals of Spectroscopy – Y. R. Sharma – S. Chand – 2008.
16. Fundamentals of Molecular Spectroscopy – 4^{th} Edition – C. N. Banwell and E. M. McCash – Tata McGrow Hill, New Delhi – 2006.
17. Elementary Organic Spectroscopy – Principles and Chemical Applications – Y. R. Sharma, S. Chand & Company Private Limited, V Revised Edition – 2013.

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

- Chemical Technology of Fibrous Materials - F. Sadov, M. Horchagin and A. Matetshy, Mir Publishers.
- The Identification of Textile Fibres - Bruno Nuntak.
- Introduction to Textile Science - 3rd edition, Maryory L. Joseph.
- Textile Chemistry – Vol. II, R. H. Peters, Elsevier, Amsterdam.
- Dyeing and Chemical Technology of Textile Fibres – 5th Edition, E. R. Trotman, Charles Griffin &Co Ltd.
- Chemistry of dyes & Principles of Dyeing – V. A. Shenai, Sevak Publications.
- Scouring and Bleaching, E. R. Trotman, Charles Griffin & Co Ltd.
- Text Book of Applied Chemistry - K. Kapur.
- 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

Introduction – Definition – Length scales – Importance of Nanoscale and its Technology – Self Assembly of Materials – Self Assembly of Molecules – Porous solids, Nanowires, Nanomachines and Quantum Dots.

UNIT-II Nanoparticles

Introduction – Types of Nanoparticles – Preparation, Properties and Uses of Gold, Silicon, Silver, Zinc Oxide, Iron Oxide, Alumina and Titania 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

Electron Microscopes – Scanning Electron Microscopes (SEM) – Transmission Electron Microscopes (TEM) – Scanning Probe Microscopy – Atomic Force Microscopy (AFM) – Scanning Tunneling Electron Microscope (STEM) – Basic Principles only.

Books for Study

- Nanotechnology, S. Shanmugam, MJP Publishers, Chennai (2010).
- A Handbook on Nanochemistry, Patrick Salomon, Dominant Publishers and Distributers, New Delhi.
- Nanobiotechnology, S. Balaji, MJP Publishers, Chennai (2010).

Books for Reference

- The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Vol. I and II, CNR Rao, Springer (2006).
- Nanotechnology: Basic Science and Emerging Technologies, Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press (2005).
- Nanochemistry, G. B. Segreev, Elsevier, Science, New York, (2006).
- Nano: The Essentials, T. Pradeep, Tata Mc-Graw Hil Publishers, New Delhi (2007).
- Text Book of Nanoscience and NanoTechnology, P. Shankar Baldev Raj, B. B. Rath and James Murday – 2014.

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

1.1 Soil – Introduction - Classification - Properties of Soil – Physical properties – Components – Structure and Texture - Soil-Water, Soil-Air and Soil-Temperature.

1.2 Chemical properties - Soil Minerals, Soil Colloids, Soil Reaction and Buffering – Analysis of Soil - Soil pH – Determination of Soil pH – Effect of pH on Plants – Buffering of soil - Soil acidity, Soil salinity and Soil alkalinity.

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

UNIT-II Fertilisers and Manures

2.1 Fertilisers – Definition - Classification – Requirements of a Good fertiliser - Nitrogen fertiliser – Urea – Preparation and Uses – Potash fertiliser – KCl, K_2SO_4 and KNO_2 - Preparation and Uses – Phosphorus fertiliser – Phosphatic slag, Superphophate of lime and Triple Superphosphate - Preparation and Uses- NPK fertiliser - Advantages– Role of Micronutrients.

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.

3.2 Fungicides – Inorganic Fungicides – Sulphur compounds – Copper compounds – Mercuric compounds – Organic Fungicides – Dithiocarbamates – Dithane M – Bordeaux mixture.

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

UNIT- IV Leather Chemistry

4.1 Introduction - Constituents of Animal Skin - Preparing Skins and Hides – Leather processing – Process before Tannage – Flaying, Curing, Drying, Pickling, Cleaning and Soaking - Liming and Degreasing.

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

- Industrial Chemistry by B. K. Sharma - Goel Publishing House, Meerut.
- Applied Chemistry by K. Bagavathi Sundari, MJP Publishers, 2006.
- Fundamental Concept of Applied Chemistry by Jayashree Ghosh, S. Chand & Company Ltd.,
- The Nature and Properties of Soils - IX Edition - Nyle. C. Bready - S. Chand.
- Soils and Soil Fertility - Louis M. Thompson - and Frederick. R. Troch - Tata Mc Graw Hill Publishing Co.
- Text Book of Soil Science - T. D. Biswas and S. K. Mukerjee - II Edition.
- Soil Science - A. Sankara.
- Fundamentals of Leather Science - Wood roffe Publications of CLRI - Chennai.
- Nature and Properties of Soils - Harry, O. Buckman.

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) <u>Molecular weight</u>

Error upto 10 %: 45

20 %: 35

30 %: 25

> 30 %: 15

3) <u>Effect of electrolyte on CST</u>

Graph: 10

Error upto 10 %: 35

20 %: 25

30 %: 15

> 30: 10

4) <u>Transition temperature</u>

Graph: 10

Error upto 2^{o}C difference: 35

7^{o}C difference: 25

> 7^{o}C difference: 15

5) <u>Conductance</u>

<u>Equivalent conductance: 25 marks</u>		**<u>Cell constant : 20 marks</u>**	
Error upto 10 %	: 25	Error upto 10 %	: 20
Upto 15 %	: 15	Upto 15 %	: 15
>15 %	: 10	>15 %	: 10

6) <u>Conductometric titration</u>

Graph: 10

Upto 2 % : 35

2.1 to 3 % : 30

3.1 to 4 % : 25

4.1 to 5 % : 20

> 5% : 15