SAKTHI COLLEGE OF ARTS AND SCIENCE FOR WOMEN, ODDANCHATRAM

(Recognized Under Section 2(f) and 12(B) of UGC Act 1956)

(Affiliated to Mother Teresa Women's University, Kodaikanal)

PG & RESEARCH DEPARTMENT OF CHEMISTRY

CURRICULUM FRAMEWORK AND SYLLABUS FOR OUTCOME BASED EDUCATION IN SYLLABUS FOR B.Sc., Chemistry

FRAMED BY

MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL

UNDER

CHOICE BASED CREDIT SYSTEM

2018-2021

Preamble:

The objective of any programme at Higher Education Institute is to prepare their students for the society at large. Sakthi College of Arts and Science envisions all its programmes in the best interest of its students. With this vision, the Department of Chemistry has been incepted with the introduction of B.Sc., (Chemistry) in 2009. Comprehending the need of its learners for higher studies, the institution introduced M.Sc., (Chemistry) in 2010 and M.Phil., (Chemistry) in 2014. The Department of Chemistry is enriched with dedicated faculty and it is facilitated with well equipped laboratories. The department provides a complete learning and quality education encompassing developments in new chemical frontier research areas in chemistry.

Fixing the Learning Objectives:

Since the Academic year 2018 – 2019, the learning objectives and outcomes of the programmes B.Sc., (Chemistry), M.Sc., (Chemistry) and M.Phil., (Chemistry) have been set, following the Bloom's Taxonomy Cognitive Domain. Accordingly, it is broken into five levels of learning objectives of each course. They are -

K1 / Knowledge = Remember

K2 / Application = Apply

K3 / Analysis = Analyze

K4 / Evaluation = Evaluate

K5 / Synthesis = Create

Mapping COs with POs:

For each programme, the Educational Objectives and the Specific Objectives are specified. The programme outcomes are designed according to the curriculum, teaching, learning and evaluation process. For each course, the definite outcomes are set, giving challenge to the cognitive domain. The course outcomes are mapped with the programme outcomes. The performance of the stakeholders is assessed and the attainment rate is fixed, by using the measurements 'high', 'medium' and 'low'. The restructuring of the curriculum is done based on the rate of attainment.

Institutional Objectives:

The institution has certain definite Institutional Objectives to be attained.

- Skill Development & Capacity Building
- Women Empowerment
- Self-reliance
- Gender Equity & Integrity

Programme Educational Objectives:

The Programmes B.Sc., M.Sc., and M.Phil., (Chemistry) are offered with certain Specific Objectives.

- To import fundamental knowledge in the field of chemistry
- The theory and practical aspect of the subject augment the abilitiy of the learner to understand the implication of scientific and technical approaches involved in the domain of the knowledge
- To mould the learner into prospective skillful scientific work force for the future.
- To use modern chemical tools , Models , Chem-draw , Chats and equipments.
- To develop research oriented skills.

Mapping PEOs with IOs:

Programme Educational Objectives	**Institutional Objectives**			
B.Sc. / M.Sc. / M.Phil., (Chemistry)	**1**	**2**	**3**	**4**
PEO1: To import fundamental knowledge in the field of chemistry. The basic principles of physical, organic, inorganic chemistry are understood by the students.	*			
PEO2: The theory and practical aspect of the subject augment the ability of the learner to understand the implication of scientific and technical approaches involved in the domain of the knowledge.		*		
PEO3: To mould the learner into prospective skilful scientific work force for the future			*	
PEO4: To use modern chemical tools, Models, Chem-draw, Charts and equipments.				*
PEO5 : To develop research oriented skills			*	

Measuring: H – High; M – Medium; L – Low

B.Sc., CHEMISTRY

Programme Outcomes: (POs)

On completion of the B.Sc., (Chemistry) Programme, certain outcomes are expected from the learners.

- **PO1:** Knowing the fundamental concepts of chemistry
- **PO2:** Studying the electronic configuration of periodic elements.
- **PO3:** Evaluating the basic foundation of the underlying principles and laws gaseous molecules.
- **PO4:** Pursuing Post graduate course in various branches of chemistry
- **PO5:** Analyzing the scientific problems and experiments creatively and critically.
- **PO6:** Developing research oriented skills
- **PO7:** Becoming professionals or entrepreneurs in the fields related to the subject of Chemistry.

ASSESSMENT PATTERN

CIA / QUESTION PATTERN & SCHEME

S.No	Section	Question Type	Marks Allotted
1	Part - A	Six questions in multiple choice pattern, testing K1 and K2 are to be given. Each question carries one mark.	03X01 = 03
2	Part - B	Two descriptive questions, with alternate options, testing K3 and K4, are to be given. Each question carries four marks.	02X02 = 04
3	Part - C	Two descriptive questions, testing K5 and K6, are to be given. Three questions are to be answered. Each question carries 15 marks.	02X04 = 08
4		Assignment	05
5		Seminar	05
		Total Marks in CIA	25

CE / QUESTION PATTERN & SCHEME

S.No	Section	Question Type	Marks Allotted
1	Part - A	Ten questions in multiple choice pattern, testing K1 and K2 are to be given. From each unit, two questions must be taken. Each question carries one mark.	10X1 = 10
2	Part - B	Five descriptive questions, with alternate options, testing K3 and K4, are to be given. Each question carries four marks. Questions are taken in the given order. Qtn. No. 11 (a) or (b) from Unit I Qtn. No.12 (a) or (b) from Unit II Qtn. No.13 (a) or (b) from Unit III Qtn. No.14 (a) or (b) from Unit IV Qtn. No.15 (a) or (b) from Unit V	5X4 = 20
3	Part - C	Six descriptive questions, testing K5 and K6, are to be given. Three questions are to be answered. Each question carries 15 marks. Questions are taken in the given order. Qtn. No. 16 from Unit I Qtn. No. 17 from Unit II Qtn. No. 18 from Unit III Qtn. No. 19 from Unit IV Qtn. No. 20 from Unit V	3X15 = 45
		Total Marks in CE	75

COMMON ACADEMIC STRUCTURE / B.Sc., CHEMISTRY / 2018 – 2021

Sem	Sub. Code	Title of the Course	Hrs	Credits	Total Marks		
					CIA	CE	Total
I	ULTA11	Part I– Tamil	6	3	**25**	**75**	**100**
	ULEN11	PartII-English	6	3	25	75	100
	UCHT11	Part III - Core I / General Chemistry I	5	4	25	75	100
	UPCHT12	Part III - Core II / General Chemistry II	5	4	25	75	100
	UCHA11	Part III / Allied – I / Theory	5	4	25	75	100
	UVAE11	Part IV / Value Education	3	3	25	75	100
		Total	**30**	**21**			**600**
II	ULTA22	Part I Tamil	6	3	25	75	100
	ULEN22	Part II English	6	3	25	75	100
	UCHT21	Part III / Core III / General Chemistry III	6	4	25	75	100
	UPHP21	Part – III / Core Practical- I Volumetric analysis estimation / Organic analysis and Organic preparation	5	4	25	75	100
	UCHA21	Part III / Allied – II / Practical- I	5	4	25	75	100
	UEVS21	Environmental Studies	2	2	25	75	100
		Total	**30**	**20**			**600**
III	ULTA33	Part I Tamil	6	3	25	75	100
	ULEN33	Part II English	6	3	25	75	100
	UCHT31	Part III Core IV / Organic Chemistry -I	5	4	25	75	100
	UCHA32	Part III Allied – III / Theory- II	5	4	25	75	100
	UCHE31	Part III Elective – I / Biochemistry	4	3	25	75	100
	UCHS31	Part IV SBS – I / Water Treatment	2	2	25	75	100
	UCHN31	Part IV ONME – I/Applied chemistry -I	2	2	25	75	100
		Total	**30**	**21**			**700**
IV	ULTA44	Part I Tamil	6	3	25	75	100
	ULEN44	Part II English	6	3	25	75	100
	UCHT41	Part III Core V / Inorganic Chemistry -I	4	4	25	75	100
	UCHP42	Part III Core Practical – II / Inorganic Qualitative Analysis	4	4	25	75	100
	UCHA42	Part III Allied – II / Practical - II	4	4	25	75	100
	UCHE42	Part III Elective – II / Medicinal Chemistry	3	3	25	75	100
	UCHS42	Part IV SBC – II / Clinical Chemistry	2	2	25	75	100

	UCHN42	Part IV ONME – II / Applied chemistry –II	2	2	25	75	100
		Total	**31**	**25**			**800**
V	UCHT51	Part III Core VI / Organic Chemistry – II	5	4	25	75	100
	UCHT52	Part III Core VII / Inorganic Chemistry - II	5	4	25	75	100
	UCHT53	Part III Core VIII / Physical Chemistry – I	5	4	25	75	100
	UCHT54	Part III Core IX /Analytical Chemistry	5	4	25	75	100
	UCHT55	Part III Core X / Spectroscopy	5	4	25	75	100
	UCHE53	Part III Elective – III / Polymer Chemistry	**3**	3	25	75	100
	UCHS53	Part IV SBE – III / Everyday Chemistry	**2**	2	25	75	100
		Total	**30**	25			700
VI	UCHT61	Part III Core XI / Organic Chemistry – III	5	4	25	75	100
	UCHT62	Part III Core XII / Physical Chemistry – II	5	4	25	75	100
	UCHT63	Part III Core XIII / Industrial Chemistry	5	4	25	75	100
	UCHP63	Part III / Core Practical III / Physical Chemistry	5	4	25	75	100
	UCHP64	Part III / Core Practical IV / Gravimetric Estimation and Organic Preparation	5	4	25	75	100
	UCHE64	Part III Elective –IV / Nano Science & Technology	3	3	25	75	100
	UCHS64	Part IV SBE - IV / Textile Chemistry	2	2	25	75	100
	UEAS61	Extension Activity	2	3	25	75	100
		Total	**30**	28			**800**
		Grand Total		**140**			**4200**

Programme: B.Sc., **Subject:** Chemistry

Semester: I **Course:** General Chemistry -I

Course Type: Part – III / Core Paper – I **Credits:** 4

Hours Required: 5 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Applying knowledge of the fundamental of hydrocarbons in organic chemistry	Application (Level 2)
Assessing the contributions of physical and chemical behaviour of hydrocarbons	Evaluation (Level 4)
Using an understanding of periodic elements	Application (Level 2)
Designing the experimental of elemental test	Synthesis (Level 5)
Solving problems of molecular weight of the compounds.	Synthesis (Level 5)

COURSE CONTENT

Unit - I

Basics of Organic Chemistry -I

a) Introduction: Sources and classification of organic compounds, Geometry of hydrocarbons. Hybridization.

b) Functional Groups: Definition – various functional groups – IUPAC – Nomenclature – Homologous series.

c) Molecular weight determination of organic acids and bases.

d) Problems to derive empirical and Molecular formula incorporating the estimation of elements and molecular weight calculations. Detection of elements - lassaigne's test.

Unit - II

Basics of Organic Chemistry -I

a) Tetravalency of carbon atom

b) Cleavage of bonds: Homolytic and heterolytic cleavages, bond energy, bond length and bond angle.

c) Electron displacement effects: Inductive, electrometric, mesomeric, resonance, hyperconjugation and steric effects.

d) Stability of Reaction Intermediates: Free radicals, carbonium and carbanion

Unit - III

Periodicity

a) Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number.

b) Horizontal, vertical and diagonal relationships in the periodic table, atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity;

electronegativity-Pauling, Mulliken- Jaffe, Allred-Rochow definitions

c) Oxidation states and variable valency; isoelectronic relationship; inert-pair effect. Atomic, molecular and equivalent weights; Avagadro's principle and mass-volume relationship.

Unit – IV Atomic Structure

a) Bohr's theory, its limitations, Particle and wave character of electron, de Broglie's theory – equation, Davission – Germer experiment – photo electric effect – Compton effect, Heisenber's uncertainty principle – the Schrodinger equation derivation

b) Postulates of quantum theory – quantum numbers and their significance

c) Pauli's exclusion principle, atomic orbitals, shapes of orbitals, filling up of orbitals Aufbau principle, (n+1) Hund's rule – Electronic configurations of the elements

Unit – V Gaseous State

a) Gaseous state: Ideal gas laws – deviations – limiting density of gases -van der Waal's -equation – Equation of state – clausius, Berthelot and Dielectric – reduced equation of state and the law of corresponding state – Compressibility factor for gases – Boyle and inversion temperature of gases and their calculations Determination of van der Waal's constants.

b) Critical phenomena of gases: PV isotherms of real and van der Waal's gases – critical state of gases. Definitions and determination of Pc, Vc, Tc – relation between van derWaal's .

Text Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice- Hall Of India Limited, New Delhi, 1992.

2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

Reference Books

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry,4th ed., Harper Collins, New York, 1993.

2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry,6thed., John Wiley, New York, 1999.

3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 1996.

4. B.R. Puri and L.R. Sharma, Principles of physicalchemistry, Shoban Lal Nagin Chand.

Online Resources:

- http://chem.libretexts.org
- http://science notes.org.

Programme: B.Sc., **Subject:** Chemistry

Semester: I **Course:** General Chemistry -II

Course Type: Part – III / Core Paper – II **Credits:** 4

Hours Required: 5 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Applying knowledge of preparation of hydrocarbons in various methods	Application (Level 2)
Assessing the contributions general characters of alkane, alkene, alkynes	Evaluation (Level 4)
Using an understanding of diagonal relationship of periodic elements	Application (Level 2)
Designing the experimental kinetis theory and its applications	Synthesis (Level 5)
Solving problems of adsorption isotherm	Synthesis (Level 5)

COURSE CONTENT

Unit – I

Hydrocarbon - I

a) Preparation by Wurtz reaction, reduction or hydrogenation of alkenes, Corey-House method, petroleum refining

b) Reactions: Mechanism of halogenation, free radical substitution, sulphonation, nitration, oxidation, cracking and aromatisation.

Alkenes

c) General methods of preparation by dehydrogenation, dehydrohalogenation, dehydration, Hoffmann and Saytzeff rules, cis and trans eliminations.

Unit – II

Hydrocarbon - II

Alkanes

a) Reactions of alkenes: Mechanism of electrophilic and free radical addition, addition of hydrogen, halogen, hydrogen halide (Markownikoff's rule), hydrogen bromide (peroxide effect), sulphuric acid, water, hydroboration, ozonolysis, dihydroxylation with $KMnO_4$ allylicbromination by NBS.

b) Stability of alkenes and dienes (conjugated, isolated and cumulative dienes).

Alkynes

c) Preparation: Mechanism of dehydrohalogenation and dehydrogenation.

d) Reactions: Acidity of alkynes, formation of acetylides, Mechanism of addition of water, hydrogen halides and halogens, oxidation, ozonolysis and hydroboration/oxidation.

Unit –III

S-Block Elements

a) characteristics of s-block elements – comparative study of elements, alkali metals and their hydroxides, oxides and halides, alkaline earth metals and their oxides, carbonates and sulphates.

b) Diagonal relationship of Li & Mg, Be & Al

Unit – IV

Kinetic Theory Of Gases

a) Kinetic theory of gases – Maxwelll Boltzmann law of distribution of molecular velocities – graphical representation – experimental verification of Maxwell velocity distribution

b) root mean square- average and most probable velocities. Mean free path,collision number collision diameter.

c) Viscosity of gases – Brownian movement and determination of Avogadro number - Loschmidt Number.

Unit -V

Surface Chemistry

a) Catalysis, definition – characteristics – theories of catalysis promoters and poisons- enzyme catalysis - acid – bases catalysis and auto catalysis with suitable examples – application.

b) Adsorption – definition of the various terms – adsorption of gases on solids – characteristics of adsorption and chemisorption – factors influencing adsorption – adsorption isotherms – Freundlich and Langmuir adsorption isotherms – BET theory(no derivation) – elementary idea – application of adsorption.

Text Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice- Hall Of India Limited, New Delhi, 1992.

2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

Reference Books

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry,4th ed., Harper Collins, New York, 1993.

2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman,Advanced Inorganic Chemistry,6thed., John Wiley, New York, 1999.

3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, ShobanLal NaginChand and Co., Delhi, 1996.

4. B.R. Puri and L.R. Sharma, Principles of physicalchemistry, ShobanLalNaginChand.

Online Resources:

- http://chem.libretexts.org
- http://pue.kar.nic.in.

Programme: B.Sc., **Subject:** Chemistry

Semester: I **Course:** Ancillary Mathematics - I

Course Type: Part – III/ Allied Theory -I **Credits: 4**

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Understanding the concept in expansion and summation of function	Comprehension (Level 2)
Learning will acquire knowledge of solving problems in matrices	Knowledge (Level 1)
Solving the interpolation problems.	Evaluation (Level 5)
Applying the formulas of trigonometric functions and related problems	Application (Level 3)
Analyzing in various types of hyperbolic functions	Analysis (Level 4)

COURSE CONTENT

Unit I:

Partial Fractions: Binomial Theorem : The General Term – Expansion of Rational Fractions – Summation of Series. Exponential Theorem: Summation of Series, The Logarithmic Series

Unit II:

Theory of Equations: Fundamental Theorem of Algebra – Symmetric Function of Roots – Relation between Roots and Coefficient of Equation – Formation of Equation – Diminish the Roots of the Equation – Reciprocal Equation Newton- Raphson Method.

Unit III:

Matrices: Fundamental Concepts :Special Types of Matrices –Addition and Subtraction of Matrices – Matrix Multiplication – Associated Matrices.Rank of a Matrix: Elementary Operations or Transformation. Linear Equations: Homogeneous linear Equation – Non-Homogeneous Equation Characteristic Roots and Vectors: Eigen Value and Eigen Vectors – Properties of the Eigen Vectors – Cayley-Hamilton theorem.

Unit IV:

Interpolations: Newton's Forward Method - Newton's Backward Method- Lagrange's Interpolation Formula: Different form of Lagrange's Interpolation Formula.

Unit V:

Trigonometry: Expansions: $\cos^n\theta$, $\sin^n\theta$ – $\cos n\theta$ and $\sin n\theta$ –Expansion of $\sin\theta$,$\cos\theta$ and $\tan\theta$ in powers of θ.Hyperbolic Function: Relation between Hyperbolic Functions and Circular Functions – Periods of Hyperbolic Functions – Inverse Hyperbolic Functions.Logarithm of Complex Quantities.

Text Book:

- P.Kandasamy, K.Thilagavathy,"Allied Mathematics Paper I", 1st Semester, S. Chand Publishing . A Division of S. Chand& Company Pvt. Ltd, Edition 2013.

Programme: B.Sc., **Subject:** Chemistry

Semester: II **Course:** General Chemistry -III

Course Type: Part – III/ Core Paper – III **Credits:** 4

Hours Required: 6 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Applying knowledge of simple term of phase rule in environment.	Application (Level 3)
Understanding the basic properties and preparation of aliphatic halogen compounds	Comprehension (Level 2)
Using an understanding the basic properties and preparation of hydroxy compounds	Application (Level 3)
Knowing the concept of phase equilibria	Knowledge (Level 1)
Solving problems in thermodynamic laws.	Synthesis (Level 6)

COURSE CONTENT

UNIT – I

Aliphatic Halogen Compounds

a) Nomenclature and classification

b) Preparation of aliphatic and aromatic halides: Free radical mechanism, addition and Substitution reactions.

c) Reactions:NuclephilicSubsititution , SN1, SN2 and SNArstereochemistryand reactivity, effects of structure,

d) substrate, solvent, nucleophile and leaving groups.

d) Eliminations E1 and E2 mechanisms, evidences, orientations and stereochemistry.

UNIT – II

Hydroxy Compounds

a) Aliphatic alcohols: preparation by hydroboration , oxidation,Reduction of carbonylcompounds, e

b) poxidation, Grignard synthesis and haloform reaction.

c) Phenols: Nomenclature, physical properties, hydrogen bonding Reactions:acidity,ether formation, ester formation ,mechanism of ring ,substitution,nitration, sulphonation, halogenation, Friedel-Craft's reaction,

nitrosation,couplingreactions, Kolbe's reaction and Riemer-Tiemen reaction.

UNIT –III

Boron and Carbon Group Elements

a) Group 13 (boron group): extraction of B and Si; types of compounds; reaction of B with other elements, water, air, acids, and alkali.

Compounds of boron with oxygen: boron sesquioxide, borazole, and borax.

b) Group 14 (carbon group): catenation and heterocatenation, allotropy of carbon-graphite,

diamond, carbides-salt-like carbides, interstitial carbides, covalent carbides., silicates in technology-alkali silicates.

UNIT – IV

Phase Equilibria-I

a) Statement of significance of the terms involving derivation of phase rule.

b) Application of phase rule to one-component systems. Water, Sulphur and Carbon dioxide.

c) Application of phase rule to two component systems- Pb-Ag, Zn- Mg Condensed systems and reduced phase rule.

d) Solids in solids: simple eutectic with suitable examples, Compound formation with congruent and incongruent melting points with suitable examples.

UNIT – V

Phase Equilibria-2

a) Ideal solutions: Vapour pressure- Composition diagrams of solutions. Raoults law, positive and negative deviations from the law. Principle of fractional distillation: Binary systems. Vapour diagram and azeotropic distillation, Variation of solubility with temperature – critical solution temperature (consolute temperature) lower, upper and critical solution temperature – influence of impurities on C.S.T. and applications.

b)Solubility of gases in liquids; Henry's law, its relationship with Raoults law.

c)Lowering of vapour pressure: Thermodynamic derivation for elevation of boiling point and depression of freezing point. Relationship between osmotic pressure and vapour pressure vant Hoff's theory of dilute solutions.

d)Distribution law: Thermodynamic derivation; limitation of the law, application in studying association, dissociation and solvation. Study of formation of complex ions. Extraction with solvents; efficiency of extraction.

Text Books

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice- Hall Of India Limited, New Delhi, 1992.

2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

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1. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry,4th ed., Harper Collins, New York, 1993.

2. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman,Advanced Inorganic Chemistry,6thed., John Wiley, New York, 1999.

Online Resources:

- http://chem.libretexts.org
- http://science notes.org.

Programme: B.Sc., **Subject:** Chemistry

Semester: II **Course:** Practical Paper – I

Course Type: Part – III/ Core Practical –I **Credits:** 4

Hours Required: 5 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Applying knowledge concentration of solution to everyday examples	Application (Level 3)
Assessing the contributions of different nature salts in organic chemistry.	Evaluation (Level 5)
Using an understanding the apparatus used in volumetric analysis and organic salt analysis	Application (Level 3)
Determining the concentration of solution in liquid state.	Evaluation (Level 5)
Solving problems of molarity, normality of the solution	Synthesis (Level 6)

COURSE CONTENT

Volumetric Analysis:

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard

Acidimetry and alkalimetry: Titration acids used: hydrochloric acid, sulphuric Standard solutions pre pared: sodium carbonate, sodium bicarbonate, oxalic acid. Potassium permanganate (permanganimetry) Reducing agents: Ferrous sulphate, ferrous ammonium Sulphate, oxalic Acid.

Standard solutions prepared: Ferrous Sulphate, ferrous ammonium Sulphate and oxalic acid.

Iodometry titrations: titrations of liberated iodine against sodium thiosulphate using acidified potassium permanganate, potassium dichromate and copper Sulphate solutions.

Standard solutions: potassium dichromate, copper sulphate.

Organic Estimation

Estimation of aniline

Estimation of phenol

Organic Analysis

Analysis of the organic substance containing the following functional groups:

Acids, phenols, aldehydes, ketones, esters, nitro compounds, amines, amides, anilides and halogenated hydrocarbons (side chain and nucleus). Monosaccharide – glucose and fructose. Report should contain aromatic or aliphatic, saturated or unsaturated and a solid derivative or a colour reaction should be exhibited

Text books:

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt.,1996

2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book ofPractical Organic Chemistry. 5th Edn., Pearson Education, 2005.

Reference Books:

1. N.S. Gnanapragasamand G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998

2. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, 2003.

3. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand& Sons, New Delhi, 2nd Edn., 2004.

Programme: B.Sc., **Subject:** Chemistry

Semester: III **Course:** Organic Chemistry -I

Course Type: Part – III/ Core IV **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Understanding the aromatic compounds and their substitution	Comprehension (Level 2)
Understanding mechanisum, isomerism and substitution of aromatic compounds	Comprehension (Level 2)
Understanding polynucler hydrocarbons and their derivatives	Comprehension (Level 2)
Understanding about stereochemistry, optical activity,and their isomerism	Comprehension (Level 2)
Learning about dyes and their synthesis	Knowledge (Level 1)

COURSE CONTENT

UNIT-I

Aromatic Compounds

i) Introduction –general characteristics of aromatic compounds. Aromaticity and Hucckel's rule.

-molecular orbital model of benzene.

ii) Homologues of benzene: preparation , properties, and uses of toluene , xylene, mesitylene and styrene.

iii) Aromatic substitution with example

a. Electrophilic , nucleophilic, and free radicals substitution , explanations and Friedal- Craft's reaction.

b. Inductive effect, elctromeric effect, Resonance- Hyperconjugation, explanation with examples.

UNIT – II

a)Mechanism of aromatic mono-substitution (electronic interpretation, nitration, sulphonation

b)Isomerism in disubstituted benzene – Korner's absolute method of orientation relative methods,

c)Directive influence of substitutents – rules of distribution Vorlandor's method. Crum-Brown, Hammic and Illingwoth's rules.

d)Electrophilic disubstitution – nucleophilic substitution unimolecular, bimolecular – benzyne mechanism – free and homolytic substitution in benzene.

UNIT-III

Polynuclear hydrocarbons and their derivatives. Isolated systems: Naphthalene, Anthracene and Phenanthrene: preparation, properties uses and structure. Derivatives of Naphthalene – preparation, properties and uses of Naphthylamines, naphthols and naphthaquionnes.

UNIT – IV

Stereiosomerism

a)isomerism of maleic and fumaric acids and aldoximes and ketoximes. Deterrmination of

configuration of geometrical Geometrical isomers – E-Z notation.

b)Optical isomerism:

i)Optical activity – specific rotation and its polarimetric determination

ii)Optical isomerism of compounds containing asymmetric carbon atom and definition of optical isomers – elements of symmetry.

meso forms – racemisation and resolution of racemic mixtures – Walden inversion – asymmetric synthesis.

iii)Optical activity of elements other carbon atoms. Quaternary ammonium compounds and tertiary amino oxides

UNIT V

Dyes: Definition – theory of colour and constitution – classification of dyes according to structure and applications

i) Azodyes – preparation of methyl orange, congo red and Bismark brown.

ii) Triphenyl methane dyes – preparation of malachite green, Rosaniline and crystal violet

iii) Phthalein Optical activity of elements other carbon atoms. Quaternary ammonium dyes –

phenolphthalein, fluorescein and eocin – preparation, structure

and properties

iv)Vat dyes – preparation and structure of Indigo.

v) Anthraquinone dye – preparation and structure of alizarin

Text Books

R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall of India Limited, New Delhi, 1992.

2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

Reference Books

1. T. W. Graham Solomons, Organic Chemistry, 6th edition, John Wiley and sons, 1996.

2. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley and Sons, New York 1996.

Programme: B.Sc., **Subject:** Chemistry

Semester: III **Course:** Allied Chemistry

Course Type: Part – III/ Allied – III / Theory- II **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Understanding the handling of chemicals and errors in chemical analysis	Comprehension (Level 2)
Getting knowledge about in chemical bonding and hybridization	Knowledge (Level 1)
Acquiring knowledge about in volumetric analysis	Knowledge (Level 1)
Understanding the basic concept of chemistry of thermodynamics	Comprehension (Level 2)
Analyzing the concept of Entropy	Analysis (Level 4)

COURSE CONTENT

Unit 1: Handling of chemicals and Data analysis

a) Storage and handling of chemicals: Handling of acids, ethers, toxic and poisonous chemicals. Antidotes, threshold vapour concentration and first aid procedure.

b) Errors in chemical analysis: Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.

c) Separation techniques–Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

Unit 2: Chemical bonding

a) Ionic Bond: Nature of Ionic bond. Structure of NaCl, KCl and CsCl. Factors influencing the formation of ionic bond.

b) Covalent Bond: Nature of covalent bond. Structure of CH_4, NH_3, H_2O based on hybridisation.

c) Coordinate Bond: Nature of coordinate bond. Coordination complexes.Werner's theory.Geometrical and optical isomerism in square planar and octahedral complexes. Mention of structure and functions of chlorophyll and hemoglobin

d) Hydrogen Bond: Theory and importance of hydrogen bonding. Types of hydrogen bonding.Hydrogen bonding in carboxylic acids, alcohol, amides, polyamides, DNA and RNA.

e) van der Waal's forces: Dipole – dipole and dipole - induced dipole interactions.

Unit 3: Volumetric analysis

a)Methods of expressing concentration: normality, molarity, molality, ppm. b)Primary and secondary standards: preparation of standard solutions c)Principle of volumetric analysis: end point and equivalence points.

d)Strong and weak acids and bases - Ionic product of water , pH, pKa, pKb. Buffer solutions - pH of buffer solutions. Mention of Henderson equation & its significance.

Unit 4: Kinetics

a) Chemical Kinetics: Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions.

b) Catalysis-Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.

Unit-5: Thermodynamics

a)Introduction: Scope and importance of thermodynamics- system and surrounding-isolated, closed and open systems- state of the system- intensive and extensive variables.Thermodynamic process- reversible and irreversible, isothermal and adiabatic process.

b)First law of thermodynamics- statement- definition of internal energy (E),enthalpy (H), applications of first law of thermodynamics.

The second law of thermodynamics: Limitations of first law and the need for the second law, different ways of stating II law and its significance, Spontaneous or irreversible process.

The concept of entropy – definition and physical significance of entropy.

Text Book

1. R. Gopalan, S. Sundaram, *Allied Chemistry,* Sultan Chand and Sons, 1995.

Reference Books

1. U. Sathyanarayana, *Biochemistry,* Books and allied (p) Ltd, 1999.

2. B.R.Puri and L.R.Sharma, *Principles of physical chemistry,* Shoban Lal Nagin Chand and Co. 33rd ed., 1992.

Programme: B.Sc., **Subject:** Chemistry

Semester: III **Course:** Biochemistry

Course Type: Part – III / Elective -I **Credits:** 3

Hours Required: 4 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Understanding about lipids and fatty acidsand cholesrterol	Comprehension (Level 2)
Understanding about proteins and their functions	Comprehension (Level 2)
Learning about aamino acids , function ,synthesis, and their classification	Knowledge (Level 1)
Differentiating nucleosildes and nucleotides	Analysis (Level 4)
Analyzing the types and functions of hormones	Analysis (Level 4)

COURSE CONTENT

Unit-I- Lipids

a) Introduction- Classification - neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) and glycolcoipids.

b) Fatty acids – saturated, unsaturated fatty acids, Properties – Hydrolysis-acid number, saponification number.

c) Cholesterol – biosynthesis. Bile salts derived from cholesterol.

d) Metabolism: biosynthesis of lipids – synthesis of fatty acids and synthesis of triglycerides

Unit-II- Proteins

a) Introduction-polypeptide chains- classification – properties-3D structure-denaturation and renaturation of protein molecules- biological functions

b) Separation and purification of proteins – dialysis – gel filtration – electrophoresis

Unit-III- Amino Acids

a) Introduction-classification –properties-structure – biological functions.

b) Synthesis of -amino acids and their identification

Unit-IV- Nucleic Acid

a) Nucleosides and nucleotides – purine and pyrimidine bases

b) DNA – Occurrence – chemical composition – double helix structure – RNA – Chemical composition – transfer RNA – Biological functions of DNA & RNA

Unit-V- Hormones

a) Introduction-Vertebrate hormones – classification – Testosterone – progesterone – Insulin

b) Biosynthesis – metabolism – functions.

Text Books

1.Lehninger, Principles of Biochemistry, Fourth Edition, by David L. Nelson and Michael M. Cox, Worth Publishers, New York, 2005.

Reference Books:

1. L. Veerakumari, Biochemistry, MJP publishers, Chennai, 2004.

2. Lubert Stryer, Biochemistry, W. H. Freeman and company, New York, 1975

Programme: B.Sc., **Subject:** Chemistry

Semester: III **Course:** Water Treatment

Course Type: Part – IV/ SBE -I **Credits:** 2

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Gaining knowledge of water quality parameters, ground water and surface water pollution and its control measures.	Knowledge (Level 1)
Practising the water treatment methods, sewage and industrial effluent treatment methods and water resources management.	Synthesis (Level 6)
Applying various methods to avoid pollutants and their effect on environment and on human health	Application (Level 3)
Comprehending the concept of BOD & COD	Comprehension (Level 2)
Learning the basic information of water treatment methods for domestic and industrial purposes	Knowledge (Level 1)

COURSE CONTENT

UNIT –I

Uses of water – safe and wholesome water – sources of water supply: Rain: hydrological cycle, acid rain, artificial rain, rain water harvesting. Surface water: impounding reservoir, river and tanks – their characteristics and impurities. Ground water; wells and springs. Water borne diseases/substances affecting the potabillity of water.

UNIT – II

Effects of impurities in natural waters: colour taste and odour, turbidity and sediment and micro organism. Dissolved mineral matter – hardness types – estimation (EDTA method) – methods of softening – boiling, addition of lime – addition of sodium carbonate – ion exchange method.

UNIT – III

Clarification of water: sedimentation and filtration. Coagulation of water electrochemical coagulation – flocculants – sterilization and disinfection of water: chemical methods and physical methods.

UNIT- IV

Demineralization of water – ion exchange process – desalination of sea water: electrodialysis method, reverse osmosis methods.

Water analysis: physical examination – chemical examination bacteriological examination – BOD, COD.

UNIT – V

Miscellaneous methods of water treatment: color, odour and taste removal – iron and manganese removal – fluoridation – deflouridation, prevention of plumb solvency – removal of slime and algae from water - de- oxygenation of water.

Text Books

1.Environmental Chemistry by B.K. Sharma and H. Kaur, Goel Publishing House.1996.

2.Environmental Chemistry, A. K. De, 5th Edn., New Age International Publisher, 2005.

3.Environmental Chemistry, B. K. Sharma, 11th Edn., Krishna Prakashan media Limited, 2007

Reference Books

1. Chemical and Biological Methods for Water Pollution Studies, R.K. Trivedy and P.K. Goel, Environmental Publications, 1986.

2. Engineering Chemistry, P.C. Jain and Monica Jain, Dhanpat Rai and Sons, 1993.

3.Water Quality and Defluoridation Techniques, Rajiv Gandhi National Drinking Water Mission Publication, 1994.

Programme: B.Sc., **Subject:** Chemistry

Semester: III **Course**: Applied Chemistry-I

Course Type: Part – IV/ ONME-I **Credits:** 2

Hours Required: 2Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Knowing about rubber and their types and synthesis	Knowledge (Level 1)
Understanding about fibers and types of fibers	Comprehension (Level 2)
Differentiating resin from plastics	Application (Level 3)
Gaining knowledge on plastics and their types	Knowledge (Level 1)
Analyzing the types and uses of fertilizers	Analusis (Level 4)

COURSE CONTENT

UNIT-I

Rubber-natural and synthetic rubbers, composition of natural rubber, neoprene rubber, styrene butadiene rubber (SBR).

UNIT-II

Fibers – definition, natural and synthetic fibers.

UNIT-III

Resins – natural and synthetic resins – distinction between resins and plastics.

UNIT-IV

Plastics – classification, properties, Bakelite, Urea, Formaldehye, Teflon, Nylon-66, and Dacron.

UNIT-V

Fertilizers – definition, classification, urea, super phosphate, potassium nitrate, mixed Fertilizer.

TEXT BOOKS

1.Norris shreve, R. and Joseph A. Brink, J. Chemical process industries, 4th ed.; Mc Graw – Hill Kogakusha, ltd: 1977.

2. George T. Austin. Shreve's chemical process industries, 5th ed.; Mc Graw – Hill: 1984.

Reference Book

1. Subba rao, N. S. Biofertilizers in agriculture; oxford and IBH publishing co.: New Delhi,

Programme: B.Sc., **Subject:** Chemistry

Semester: IV **Course:** Inorganic chemistry -I

Course Type: Part – III/ Core V **Credits:** 4

Hours Required: 5 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Applying gained knowledge on the arrangement of elements in the periodic table group 15 and group 17	Application (Level 2)
Assessing the identification of the nature of chemical bond in a given inorganic compound.	Evaluation (Level 5)
Using the apparatus used in volumetric analysis and organic salt analysis	Application (Level 3)
Determining the existence of special types of compounds through weak chemical forces.	Synthesis (Level 5)
Solving problems of Bragg's equation.	Synthesis (Level 5)

COURSE CONTENT

UNIT – I

GROUP-15 (NITROGEN GROUP) & GROUP-17 (HALOGENS)

a) Metallic and nonmetallic character of group 15 elements; hydrides and halides of group 15 elements, hydrazine, hydroxylamine, phosphines

b) Oxides of N and P: oxides of nitrogen-dinitrogentetroxide, phosphorous pentoxide, Properties and uses of phosphites and phosphates; phosphate fertilizers.

c) Group-17 (halogens): anomalous behavior of F, ionic-, covalent-, bridging halides, reactivity of halogens, Oxoacids of halogens: hypohalous acid HOX, halous acid HXO_2 ,halic oxide HXO_3, perhalic acid HXO_4, strength of oxoacids .

d) Interhalogencompound : ClF_3, BrF_3,IF_3, IF_5 - (structure only): VSEPR model.

UNIT – II

IONIC BONDING

a) Properties of ionic compounds, energetics of formation of ionic compounds,Latticeenergy: Born-Lande equation, Born-Haber's cycle

b) Covalent character of ionic compounds-Fajan's rules, solubility, melting points, and thermal stability of typical ionic compounds.

UNIT – III

COVALENT BONDING

a) Lewis theory-Octet rule and its exception, electron dot structural formula, Sidgwick-Powell theory-prediction of molecular shapes

b) Valance Bond theory-arrangement of electrons in molecules. Hybridization (sp^2, sp^3, sp, sp^3d, sp^3d^2 - with suitable examples) and geometry of molecules. VSEPR theory- Effect of bonding and

nonbonding electrons on the structure of molecules.

c) MO theory: MO diagram for simple homonuclear molecules - carbon, nitrogen, oxygen, chlorine and Heteroatomic molecules -hydrogen chloride – Bond orderand stability, comparison between valence bond and molecular orbital method.

UNIT – IV

METALLIC BONDING AND WEAK CHEMICAL FORCES

a) Metallic bond: Metallic properties, band theory of metals; semiconductors: n- and p-type semiconductors.

b) Weak forces: Hydrogen bonding-intra- and intermolecular hydrogen bonding,

Influence on the physical properties of molecules, van der Waals forces, ion-dipole forces, interactions.

UNIT -V

SOLID STATE STRUCTURE AND METALLURGY

a) Classification of solids- Isotropic and anisotropic crystals- elements of symmetry, seven crystal systems, Miller indices, space lattice and Unit cell.

b) X-ray diffraction- derivation of Bragg's equationStructures of NaCl, CsCl and ZnS.

c) Metallurgy : Occurrence of metals – concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process, purification of metals – electrolysis, zone refining, Van Arkel de-Boer process.

Text Book

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry, 4th ed., Harper Collins, New York, 1993

Reference Books

1. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry 6 th ed., John Wiley, New York, 1999.

2. T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.

3. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry , ShobanLal NaginChand and Co., Delhi, 1996.

Programme: B.Sc., **Subject:** Chemistry

Semester: IV **Course:** Ancillary Chemistry –Practical-II

Course Type: Part – III/ Allied – II **Credits:** 4

Hours Required: 4 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Learning to make solution of various molar concentration.	Application (Level 3)
Calculating the conversion of gram to molarity	Evaluation (Level 5)
Using an understanding of various apparatus useage	Application (Level 3)
Becoming capable of doing experimental projects and execute them.	Synthesis (Level 6)
Solving problems of molarity and normality.	Synthesis (Level 6)

COURSE CONTENT

I. Acidimetry and alklimetry

a. Titration between a strong acid against NaOH

b. Titration between a strong acid against Na

c. Titration between sodium hydroxide against oxalic acid

II. Permanganometry

a. Titration between $KMnO_4$ against oxalic acids

b. Titration between $KMnO_4$ against ferrous sulphate

c. Titration between $KMnO_4$ against mohr salt(ferrous ammonium sulphate)

III. Iodometry:

a. Titration between sodium thiosulphate and potassium dichromate

b. Titration between sodium thiosulpate and copper sulphate

Text books

1.Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt.,1996

2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

Reference Books

1. N.S. Ganapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.

2. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, 2003.

3. Basic Principles of Practical Chemistry, V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu, Sultan Chand& Sons, New Delhi, 2nd Edn., 2004.

Programme: B.Sc., **Subject:** Chemistry

Semester: IV **Course:** Medicinal Chemistry

Course Type: Part – III/ Elective-II **Credits: 3**

Hours Required: 3 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Understanding the basic concepts and strategies in drug design and synthesis.	Comprehension (Level 2)
Providing the preliminary introduction to vitamins and their classification	Knowledge (Level 1)
Using an understanding of sulpha drugs and antimalarial activity.	Application (Level 3)
Working out the knowledge on Anesthetics drugs, antibiotics and their synthesis	Synthesis (Level 6)
Practising the gained knowledge on anaesthetics in daily life.	Synthesis (Level 6)

COURSE CONTENT

UNIT – I

Introduction and Importance of Chemistry in Pharmacy

Important terminologies used their meaning – molecular pharmacology – pharmacodynamics, pharmacophore – metabolites, antimetabolits – drugs – definition – important drugs dosage – Indian medicinal plants and trees.

UNIT – II

Vitamins

Definition – classification – source, therapeutic uses and deficiency of vitamin A, vitamin B B_2 , B_6 vitamin D vitamin E and K.

UNIT – III

Sulpha Drugs, Antimalarials

Sulpha drugs _ sulphadiazine. Prontosil, prontosil – S – antimalarials, quinine, plasmoquinine

UNIT – IV

Anesthtics

Definition – transport of anaesthetics – halogenated hydrocarbons – chloroform – ethylchloride – trichloroethylene – gaseous anesthetics – cyclopropane and nitrous oxide – localanesthetics, classification, characteristics – benzocine, piperocaine and lidcaine.

UNIT – V

Antibiotics

Definition – pencillins, teracyclins, teramycin, streptomycin and chloromycetin.

Text Book

1. JayashreeGhosh, A Text book of Pharmaceutical Chemistry, S. Chand& Co., New Delhi, **2009.**

Reference Book

2. AshutoshKar, Medicinal Chemistry, New Age International Publisher, New Delhi, 3rd Edn.2006.

Programme: B.Sc., **Subject:** Chemistry

Semester: IV **Course:** Clinical Chemistry

Course Type: Part – IV/ SBE-II **Credits: 2**

Hours Required: 2 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Understanding clinical biochemistry and laboratory practices	Comprehension (Level 2)
Gaining knowledge of important of vitamins in daily life.	Knowledge (Level 1)
Using an understanding of blood and composition	Application (Level 2)
Determining the normal and abnormal constituents of urine through laboratory practices	Synthesis (Level 5)
Solving the problems of vitamin deficiency	Synthesis (Level 5)

COURSE CONTENT

UNIT – I

Blood – composition and their role in health and disease, blood grouping, Rh factor, Blood p^H.

UNIT–II

Electrolytic balance, function of plasma proteins, Albumin – Globulin ratio, clotting mechanism, blood pressure, coagulant and anticoagulant.

UNIT –III

Blood lipid, arteriosclerosis, lipid profile, blood sugar, blood glucose and its regulation, glucose tolerance test (GTT).

UNIT –IV

Urine – normal and abnormal constituents of urine, renal function test.

UNIT –V

Only demonstration

a. Blood grouping
b. Rh factor
c. Blood Glucose
d. Hb content

Text Book

1.Practical Clinical Biochemistry: Methods and Interpretations, R. Chawla, 3rd Edn., Jaypee Brothers Medical Publishers, New Delhi, 2003.

Reference Book

1. Fundamentals of Practical Clinical Biochemistry, B. Mohanty and S. Basu, B. I. publishers, New Delhi, 2006.

Programme: B.Sc., **Subject:** Chemistry

Semester: IV **Course:** Applied chemistry -II

Course Type: Part – IV/ ONME-II **Credits:** 2

Hours Required: 2 Hrs / Week **CIA:** 25 **CA:** 75

Course Outcomes:

Description	Blooms' Taxonomy Level
Understanding the knowledge on Applied Chemistry	Comprehension (Level 2)
Gaining knowledge in silicate industry, match industry.	Knowledge (Level 1)
Using an understanding of the Pollution occurring from various sources and resulting toxic effects	Application (Level 2)
Analyzing the dangers involved in Explosives	Analysis (Level 4)
Solving the problems in day to day life by the gained knoeledge in applied chemistry .	Synthesis (Level 5)

COURSE CONTENT

UNIT – I

Match Industry – Raw materials – manufacturing process, pyrotechnics coloured smokes.

UNIT – II

Explosives – definition classification, Nitroglycerine, dynamite cordite, TNT and Picric acid.

UNIT – III

Silicate Industry – Cement and Glass, Raw materials and manufacture of cement and glass.

UNIT – IV

Petrochemicals – definition, origin, composition chemicals from natural gas, petroleum, light naphtha and kerosene, LPG.

UNIT – V

Photography – colour photography.

Text Books

1.Norris Shreve, R. and Joseph A. Chemical process industries, 4th ed.; Mc Graw – Hill Kogakusha, ltd: 1977.

2. George T. Austin. Shreve's chemical process industries, 5th ed.; Mc Graw – Hill: 1984.

Reference Books

1. SubbaRao, N. S. Biofertilizers in agriculture; oxford and IBH publishing co.: New delhi,1982.

2. Jain, P. C. and Jain, M. Engineering chemistry, 10th ed.; DhanpatRai and sons: Delhi, 1993.

3. Kamaraj, P.; Jeyalakshmi, R. and Narayanan, V. Chemistry in engineering and technology; Sudhandhira publications: chennai, 2001.

4. Kuriakose, J. C. and Rajaram, J. Chemistry in engineering and technology. Vol2.; Tata Mc Graw Hill: New Delhi, 1988

5. De, A.K. Environmental chemistry 2nd ed.; Wiley Eastern Ltd., 1987.

Programme: B.Sc., **Subject:** Chemistry

Semester: V **Course:** Organic chemistry II

Course Type: Part – III/ Core VI **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course Outcomes:

Description	Bloom's Taxonomy level
Understanding the difference of aromatic and aliphatic acids.	Comprehension (Level 2)
Identifying the nitrogen containing compounds.	Analysis (level 4)
Gaining knowledge of carbohydrates and its types.	Knowledge (Level 1)
Evaluate the structure of starch and cellulose	Evaluation (level 5)
Applying the importance of aromaticity to the organic compounds	Application (Level 3)

COURSE CONTENT

UNIT – I

a) Aliphatic acids

i) Resonance of carboxylate ion-relative strengths of carboxylic acids.

ii) Halogen substituted acids. Preparation and properties of monochloro.Dichloro and trichloro acetic acids. The overall reactivity of halogen and the influence of halogen atom onthe strength of acids.

iii) Amino acids: Preparation and properties of glycine, alanine and phenyl alanine. Action of heat on α, β, and γ amino acids.

iv) Dicarboxylic acids

i) Saturated acid, preparation and properties of malonicacid –Malonicester,its synthetic uses – succinic, glutaric and Adipic acids – rule.

ii) Unsaturated acid: Preparation and properties of maleic and fumaric acids.

UNIT –II

Aromatic acids

i) Benzoic and Toluic acids. Effect of substituent on acidic characters.

ii) Substituted benzoic acid – salicylic and anthranilic acids – preparation And properties.

iii) Dicarboxylic acids – preparation and properties of phthalic acid, isophthalic acid and terephthalic acids. Derivatives of phthalic acid-phthalic anhydride and phthalimide.

iv) Sidechain carboxylic acids: Preparation and properties of phenylacetic acid, mandelic acid and cinnamic acid – coumarin.

v) Acid derivatives – synthesis and reactions of acid halides, amides, Anhydrides and esters.

UNIT – III

Alicyclic Compound

General method of preparation and properties of cycloparaffins – Baeyer's Strain theory and its modifications. Conformational analysis – Fischer's plane Projection formula – Newmann's projection formula and Sawhorse formula of ethane, 1,2 Cyclic ketones – Civetone and muscone.

UNIT- IV

Nitrogen Compounds

Aliphatic nitrogen compounds

i. Cyanides and isocyanides – General method of preparation And properties – Distinctionbetweenethylcyanide and isocyanide

ii. Alkyl nitrites and nitro alkanes – General method of preparation and properties – Distinction between ethyl nitrite and nitroethane – tautomerism in nitro compounds.

iii. Amines: Classification – Quaternary ammonium compounds – Basic character of amines. Aliphatic diazo compounds – preparation, properties and Structure of diazomethane and diazoacetic ester.

Iv. Derivatives of carbonic acid

a. Manufacture, properties, structure and uses of urea – Estimation of urea.

b.Aromatic amino compounds – preparation and properties of isomers of toluidines –estimation of amine.

UNIT – V

Carbohydrates

a.Monosaccharides – detailed study of glucose and fructose – structure and configuration – mutarotation and epimerization – Interconversion glucose And fructose – Descent and ascent of the sugar seires – Estimation of Glucose.b.Disaccharides – structure and properties of sucrose. c.Polysaccharides – structure of starch and cellulose – applications of cellulose derivatives.

Book for study

1.R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992.

2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), NewDelhi, reprint, 2002.

Books for Reference

1. T. W. Graham Solomons, Organic Chemistry, 6th edition, John Wiley and sons, 1996.

2. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley and Sons, New York,1992.

3. S. H. Pine, Organic Chemistry, 5th Edition, Mc Graw Hill International Edition, Chemistry Series, New York, 1987.

4.Sehan. N. Ege, Organic Chemistry, Structure And Reactivity, 3rd Edition, A.I.T.B.S., New Delhi, 1998.

Online Resources:

1.https:// www.teacheron.com/online-organic chemistry-tutors

2.https://www.masterorganicchemistry.com

Programme: B.Sc., **Subject:** Chemistry

Semester: V **Course:** Inorganic Chemistry II

Course Type: Part – III/ Core VII **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Predicting the types of isomers in coordination compounds	Analysis (Level 3)
Assessing the name of coordination compounds and to be able to draw the structure based on its name	Evaluation (Level 5)
Gaining knowledge of various metal ions present in Our body	Knowledge (Level 1)
Understanding the concept of nuclear chemistry and radiation chemistry	Comprehension (Level 2)
Identifying the difference between the nuclear fission, fusion process.	Analysis (Level 4)

COURSE CONTENT

UNIT - I

Coordination Chemistry I

a)Introduction - Types of ligands: unidentate, bidentate and polydentateligands, chelating ligands and chelates- IUPAC nomenclature of coordination compounds.

b)Isomerism in coordination compounds: Structural isomerism, hydrate isomerism, coordination isomerism, ionisation isomerism, linkageisomerism, coordination position isomerism.

c)Stereoisomerism: Geometrical isomerism of four and six coordinate complexes, optical isomerism of four and six coordinate complexes.

d) Werner and Sidgwick theories, methods of detecting complex formation

UNIT –II

Coordination Chemistry II

a)Theories of coordination compounds : Valence bond theory, limitations ofvalence bond theory, crystal field theory – splitting of d orbitals in octahedral, tetrahedral and square planar fields, CFSE, factors affecting CFSE, colour, geometry and magnetic properties of coordinationcompounds, Jahn – Teller distortion (an elementary idea).

b)Synthesis of Coordination Compounds: *Cis*- and *trans*-effects in synthesis of square planar and octahedral complexes.

UNIT-III

a)Bioinorganic Chemistry

Role of metal ions biological systems –metalloporphyrins , porphyrins – chlorophyll, heme proteins - hemoglobin and myoglobin,vitamin B12 (structure only)

b) Acids And Bases

Modern concept of acids and bases – Arrhenius, Bronsted – Lewis concept – Usanovichconcept – introduction to non-aqueous solvents – leveling effect – differentiating solvent –
reactions in liquid ammonia in detail.

UNIT IV

Nuclear Chemistry And Radiation Chemistry

a) The nucleus: subatomic particles, structure of the nucleus-forces in the nucleus-mesons; stability of nucleus-n/p ratio, mass defect &binding energy; radioactive elements. Factors affecting stability of nucleus-binding energy per nucleon, n/p ratio, magic number, odd-even rule, nuclear models – liquid drop and shell models, isobars, isotones and isomers.

b) Natural and induced radioactivity; radioactive decay; neutron emission, positron emission, electron capture; Unit of radioactivity (Curie); half life period; Geiger- Nuttal rule, radioactive displacement law, radioactive series. Measurement of radioactivity: ionization chamber, Geiger counters, scintillation counters..

c) Applications: energy tapping, dating of objects, neutron activation analysis, isotopic labeling studies, nuclear medicine-99mTc radiopharmaceuticals.Hazards of radiations

UNIT – V

Nuclear Reactions

a)Nuclear reactions: types of nuclear reactions, nuclear cross section, spallation Nuclear fission and fusion: Theories of fission, application of fission and the principle of atom bomb – nuclear fusion and emission of energy, stellar energy and Hydrogen bomb. nuclear reactors-fast breeder reactors, fuels used in nuclear reactors, moderators, coolants;

b)Particle accelerators: Linear accelerator cyclotron and synchrotron.

Book for study

1.J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorganic Chemistry,4th ed., Harper Collins, New York, 1993.

2.F. A. Cotton, G. Wilkinson, C. Murillo and M.Bochman, Advanced Inorganic Chemistry,6thed., John Wiley, New York, 1999.

Books for reference

1.T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.

2.B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry , ShobanLal NaginChand and Co., Delhi, 1996.

Online Resources:

1.https://tutorme.com/inorganic-chemistry-tutors/

2.https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry

Programme: B.Sc., **Subject**: chemistry

Semester: V **Course:** Physical Chemistry - I

Course Type: Part – III/ Core VIII **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Understanding the statistical thermodyanamics.	Comprehension (Level 2)
Analysing the third law of thermodynamics and concept of fugacity and activity.	Analysis (Level 4)
Gaining knowledge of concept of thermodynamic probability	Knowledge (Level1)
Deriving the kinetics of different types of reaction.	Creation (Level 6)
Applying the reaction rate theories and reaction in solution.	Application (Level 3)

COURSE CONTENT

UNIT – I

Thermodynamics – I

Introduction: Scope and importance of thermodynamics – energy and its Units – mechanical work and heat and their relation – thermodynamic systems and their characteristics – state of a system – state function and path function and their characteristics – thermodynamic functions – exact and inexact differentials.

First L aw: Statement – mathematical formulation – change in constant pressure – Cp-Cv relationship – work done in isothermal, reversible expansion and compression of an ideal gas – Calculation of E, H and w for adiabatic reversible expansion. Reversible isothermal expansion of a rea gas – calculation of E, q, w and H for a van derwaal's gas – Joule-Thomson effect ($\Delta E/ \Delta V$)T value for ideal gas – temperature, calculation and significance.

UNIT – II

Thermodynamics – II

Variation of enthalpies with temperature – Kirchoff's equation – Hess's law of constant heat summation – statement and applications.

Bond enthalpies – definition – calculation from the thermo chemical data and applications.

Zeroth law of thermodynamics and its significance.

Thermodynamics – II

II law of thermodynamics - object of the II law – different ways of stating II law and its significance. Conversion of heat into work – carnot'stheorm and cycle – Thermodynamic efficiency – thermodynamic scale of temperature

UNIT – III

Thermodynamics – III

Entropy – definition and significance the concept of entropy – entropy changes in isolated systems – entropy as a thermodynamic function dependence of entropy on variables of the system.

Entropy changes in ideal gas, in mixing of gases, physical transformations and in chemical reactions. Entropy and probability Free energy functions Helmholtz free energy (A) -definition and temperature dependence- Gibb's free energy with temperature and pressure – Gibb's-Helmholtz equation and its applications – Maxwell's relations.

UNIT – IV

Partial molar quantities: chemical potential – relationship between partial molar quantities – Gibb's Duhem equation – chemical potential in case of a system of ideal gases – application of the concept of chemical potential – Clausius-Claypeyron equation – derivation and its applications.

Thermodynamics – III

Nernst heat theorem and its application - Third law of thermodynamics – a simple treatment of the law. Temperature dependence of heat capacity and its use in the determination of absolute entropy. Exceptions to III law – residual entropy of CO,N_2O, H_2O and H_2

UNIT – V

Chemical Kinetics:

Rate of a reaction – rate law and rate constant – order and molecularity of a reaction.

Reactions of first order and pseudo first order reaction – derivation of rate constant and half life period – catalytic decomposition of hydrogen peroxide, conversion of N-chloro acetanilide to p-chloro acetanilide, decomposition of dinitropentoxide – hydrolysis of ester by acids – inversion of canesugar.

Reaction of II order: derivation of rate constant and half-life period – saponification of ester.

Reactions of III order: derivation of rate constant and half-life period. Reaction between $FeCl_3$and $FeCl_2$

Methods of determining the order of reactions.

Reactions of zero order surface reactions – derivation of rate law – specific examples.

Influence of temperature on the rate of a reaction – Arrhenius rate equation and its significance – measurement of Arrhenius parameters, A and Ea.

Theory of reaction rates – Collision theory – unimolecular reactions – Lindemann – Theory of absolute reaction rates.

Book for study

1. S.H. Maron and J.B. Lando, Fundamentals of Physical Chemistry, Macmillan limited, NewYork, 1966.

2. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, ShobanLalNaginchand and Co. 33rd edition, 1992.

Book for Reference:

1. P.W. Atkins, Physical Chemistry, 7th edition, Oxford university press, 2001.

2. S.K. Dogra and S. Dogra, Physical Chemistry Through Problems, New age international, 4 th edition 1996

3. Gilbert. W. Castellan, Physical Chemistry, Narosa publishing house, third edition 1985.

4. Irving M. Klotz and Robert M. Rosenberg, Chemical Thermodynamics, John Wiley and sons, Inc. 1994.

5. J. Rajaram and J.C. Kuriacose, Thermodynamics, ShobanLalNaginChand and CO. 1986.

6. K. L. Kapoor, A Textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd,1994.

Online Reference:

1. https://www.khanacademy.org

2. https://www.varsitytutors.com

Programme: B.Sc., **Subject**: Chemistry

Semester: V **Course:** Analytical Chemistry

Course Type: Part – III/ Core IX **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Applying the knowledge of good laboratory practices and its applications.	Application (Level 3)
Predicting the error and learn minimization of errors.	Analysis (Level 4)
Understanding the separation and identification of compounds by chromatographic methods.	Comprehension (Level 2)
Deriving the electroanalytical techniques	Creation (Level 6)
Understanding the advanced methods of separation and analysis	Comprehension (Level 2)

COURSE CONTENT

UNIT- I

Handling Of Chemicals And Analysis

a) Safety and hygiene in the Chemistry Lab

Storage and handling of chemicals, handling of acids, ethers, toxic and poisonouschemicals, antidotes, threshold vapour concentration and first aid procedure. Heatingmethods, stirring methods filtration techniques. Calibration of pipette, standard measuring flask and burette.Weighing principle in chemical balance and single pan balance

b)Errors: Definition – terms- absolute and relative error – precission and accuracy – Methods of expressing precision: mean, median, deviation, average deviation and coefficient of variation -classification of errors - t-test rejection of experimental data – Q-test sources and elimination of errors or Minimizing errors -Significant figures and its application with respect to the glassware used. Normal error curve and its importance

UNIT-II

Purification Techniques

a)Chromatography

Definition of Chromatography, mobile phase and stationary phase. Classification of Chromatography.Principle of adsorption and partition chromatography.

b)Column chromatography: requirement of a good adsorbent- solid stationary phase-liquid stationary phase ,adsorbents, classification of adsorbents, solvents, preparation of column, applications.

c)Thin Layer Chromatography: choice of adsorbent, choice of solvent, preparation of chromatogram, preparation of plate, developing chambers, development of plate, Rfvalue,applications.

d)Paper chromatography: types of paper used, various method of development (ascending, descending and radial) solvent used, Rfvalue,factors which affect,Rf value Separation of amino acids by paper chromatography – TLC is superior to other methods of chromatography.

UNIT-III

Solubility Equilibria

a) **General Separation Techniques**

Solubility and solubility products, expressions for solubility products. Determination of solubility from solubility products.

b)**Precipitation titrations**

Argentometric titrations, indicators for precipitation titrations involving silver.Determination of chloride by Volhard's method. Adsorption indicators.

c) **Gravimetric methods of analysis**

Separation by precipitation, factors affecting solubility, gravimetric factor. Purity of precipitates, vonWeiman ratio. Co-precipitation, post precipitation. Precipitation from homogenous solution.

UNIT –IV

Titrimetric Methods Of Analysis

a)General Introduction

General principle. Types of titrations. Requirements fortitrimetric analysis. Concentration systems: Molarity, formality, normality, wt% ppm, milliequalence and millimoles-problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point

b)Acid-base Equilibria

pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from Ka and Kb values.Neutralisation-titration curve, theory of indicators,choice of indicators. Use of phenolphthalein and methyl orange.

c)Complexometric titrations

Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics.

UNIT-V

Atomic Absorbtion Spectroscopy

Introduction, Instrumentation source, burner, flame, monochromators, Detectors, Double

beam Absorption Spectrometer, Interference, Applications.

Thermal Analysis

Thermal analytical methods, principle involved in thermogravimetric analysis and differential gravimetric analysis, discussion of various components with block diagram, characteristics of TG and DTA, Factors affecting TG and DTA curves.

Polarography

Introduction—migration current-diffusion current-residual current-polagram-Instrumentation-advantages of DME-Ilkovic equation (no derivation)- Applications.

Book for study

1. D.A. Skoog, D.M. West and F.J. Holler, Analytical Chemistry: An Introduction, 5th edition, Saunders college publishing, Philadelphia, 1990.

2. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 1995.

Book for Reference

1. R.A. Day Jr. A.L. Underwood, Quantitatives Analysis, 5th edition, Prentice Hall of India Private Ltd., New Delhi, 1988.

2. Elementary Organic Spectroscopy: Principles and Chemical Applications, S.Chand and company Ltd., Ram Nagar, New Delhi, 1990.

3. V.K. Srivastava, K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 1987.

4. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders international editions.

5. A.K. Srivastava, P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi.

Online Reference:

1. https;//chem.libertexts.org

2.https;//edu.rsc.org

Programme: B.Sc., **Subject**: Chemistry

Semester: V **Course:** Spectroscopy

Course Type: Part – III/ Core X **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Applying various analytical techniques to drug analysis and control, e.g. spectroscopic, chromatographic, etc	Application (Level 3)
Assessing the various analytical methods to purity of formulations	Evaluation (Level 5)
Gaining understanding of and skills in advanced methods of separation and analysis	Comprehension (Level 2)
Predicing practical experience in selected instrumental methods of analysis	Application (Level 3)
Activating the skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments	Synthesis (Level 6)

COURSE CONTENT

UNIT – I

Introduction And Microwave Spectroscopy

Regions of electromagnetic spectrum – parameters of electromagnetic radiation – molecular spectroscopy – Born-Oppenheimer approximation - Electronic, vibrational and rotational energy levels, and transitions in atoms and molecules.Absorption and emission spectra Microwave spectroscopy – rotational spectra of diatomic molecules (rigid rotors), frequency separation – determination of moment of inertia and bond length.

UNIT – II

Ir Spectroscopy

Principle – types of stretching and bending vibrations. vibrational frequency – factors influencingvibrational frequencies – instrumentation, fingerprint region, study of hydrogen bond. Raman spectroscopy – Rayleigh and Raman scattering – stokes and anti-stokes lines. Comparison of Raman and IR spectroscopy- Mutual exclusion principle, applications

UNIT – III

Electronic Spectroscopy

Beer –Lambert's law, Types of electronic transitions, chromophore, auxochrome, absorption

Maximum λ_{max} and intensity of absorption bands, factors influencing λ_{max} and intensity - instrumentation of UV-Visible spectrophotometer, Frank-Condon principle

UNIT – IV

Nuclear Magnetic Resonance Spectroscopy

Principle, basic instrumentation, shielding mechanism, chemical shift, multiplicity, spin-spin coupling and coupling constants.

UNIT – V

Mass Spectroscopy

Principle, molecular ion peak, base peak, isotopic peak, metastable peak fragmentation – nitrogen rule.Mass spectrum of simple organic compounds (acetaldehyde, ethyl alcohol, methyl amine and toluene).

Book for study

1.Elementary Organic Spectroscopy: Principles and Chemical Applications, S.Chand and company Ltd., Ram Nagar, New Delhi, 1990.

2. V.K. Srivastava and K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and company, New Delhi, 1987

Book for Reference

1. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, and A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders international editions.

2. A.K. Srivastava and P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons.and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi.

Online Resoureces

1. https://www.spectroscopyeurope.com

2. https://www.spectroscopyonline.com

Programme: B.Sc., **Subject**: Chemistry

Semester: V **Course:** Polymer Chemistry

Course Type: Part – III/ Elective-III **Credits:** 3

Hours Required: 3 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Evaluating areas of fundamental concepts of polymer chemistry	Evaluation (Level 5)
Assessing the nomenclature of polymer, degree, types, mechanism and kinetics of polymerization and characterization of polymer	Evaluation (Level 5)
Understanding the chain growth and step growth polymerization and preparation, property uses of some industrially important polymers	Comprehension (Level 2)
Describing the morphology, structure and physical properties of polymers.	Analysis (Level 4)
Analysing the different polymer processing techniques	Analysis (Level 4)

COURSE CONTENT

UNIT – I

Introduction – Monomers, Oligomers, Polymers and their characteristics-Degree of polymerization- Functionality of polymer-Classification of polymers-addition polymers – PVC, orlon, Condensation polymers – Definition, Dacron, Nylon 6-Nylon 6,6 – preparation properties,uses – copolymers – preparation, properties and uses of saron.

Bonding in polymers : Primary and secondary bond forces in polymers.Mechanism of addition polymerization – free radical polymerization – ionic polymerization

UNIT-II

Thermoplastics and thermosetting polymers.

Thermoplastics : Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly Vinyl Chloride, Poly tetrafluoro ethylene, nylon and polyester.ThermosettingPlastics : Phenol formaldehyde and epoxide resin

UNIT – III

Elastomers or Rubber – natural rubber – compounding of rubber, properties, uses, synthetic rubbers – buna-s neoprene, silicone rubber.ConductingPolymers,examples : poly sulphur nitriles, poly phenylene, polypyrrole and poly acetylene.

UNIT-IV

Molecular weight determination – number average, weight average methods of determination – osmotic pressure, viscosity, light scattering methods.

UNIT-V

Inorganic polymers – introduction – general properties – glass transition temperature classification – preparation, properties and uses of Boron Nitride, silicone rubber.

Book for study

1. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996.

2. N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.

Book for Reference

1. A. Kumar and S. K. Gupta, Fundamentals and Polymer Science and Engineering, TataMcGraw-Hill, 1978

2.Gowariker V.R., Viswanathan N.V. and JayaderSreedhar, Polymer Science, Wiley EasternLtd., New Delhi, 1978

3. Sharma, B.K., Polymer Chemistry, Goel Publishing House, Meerut, 1989.

4. Arora M.G., Singh M. and Yadav M.S., Polymer Chemistry, 2nd Revised edition, anmolPublications Private Ltd., New Delhi, 1989.

Online Resources:

1. https://www.rsc.org
2. http://polymerdatabase.com

Programme: B.Sc., **Subject**: Chemistry

Semester: V **Course:** Everyday Chemistry

Course Type: Part – IV/ SBE-III **Credits:** 2

Hours Required: 2 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Understanding the chemistry in milk and milk products	Comprehension (Level 2)
Gaining knowledge about safety matches and their composition	Knowledge (Level 1)
Assessing the preparation of wax products	Evaluation (Level 5)
Predicting the application of chemistry in every day of life	Application (Level 3)
Evaluating the use of food chemistry	Evaluation (Level 5)

COURSE CONTENT

UNIT – I

Dairy chemistry milk – definition – general composition of milk – constituents of milk lipids, proteins, carbohydrates, vitamins and minerals. Physical properties of milk – colour, odour, acidity, specific gravity, viscosity and conductivity. Factors affecting the composition of milk – pasteurization, homogenization, toning, standardization, reconstitution of milk - adulteration of milk.

UNIT – II

Mineral metabolism: calcium – source, daily requirement, blood calcium, hypocalcemia, phosphorus – functions of phosphate, requirement, source, normal serum level, functions. Sodium – normal level of sodium, excretion of sodium, restriction of sodium in diet, hypernatremia.

UNIT – III

Preparation of tooth powder, paste, talcum powder, shampoo, handkerchief perfumers, dry perfume sachets, soap powder, diswashing powder, various soaps, toilet cleaning liquids.

UNIT – IV

Wax products – candles, boot polish, furniture polish paste. Ink – blue, red, blue black, white board marker, printing ink, ink for stamp pad.

UNIT-V

Safety matches –agarbathies naphthalene balls – chalk crayons – insecticides such as lice killer, mosquito repellant, cockroach terminator, mot repellant. Simple medicines: pain balm, digestive tablet,

disinfectant solutions

Books for study

1. Swaminathan M. Advanced Text Book on Food and Nutrition , volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.

2. Swaminathan M. Text Book on Food chemistry, Printing and Publishing CO., Ltd., Bangalore. 1993.

3. Norman N. Potter , Food science, CBS publishers and distributors, New Delhi. 1994.

4. Lillian Hoagoland Meyer, Food Chemistry, CBS publishers and distributors, New Delhi. 1994.

Books for Reference

1. Owen R Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.

2. Srilakshmi B., Food Science, New age International Pvt. Ltd. Publishers, III ed. 2003.

3. Siva Sankar B., Food Processing and Preservation. Prentice – Hall of India Pvt. Ltd., NewDelhi. 2002.

4. Ramakrishnan S., Prasannam K.G and Rajan R –Principles. Text book of medical biochemistry. Orient Longman Ltd. III ed. 2001.

5. ShakuntalaManay N. and Shadaksharaswamy M. FOODS: Facts and Principles. New age International Pvt. Ltd. Publishers, II ed. 2002

Online Resources:

1. https://ncert.nic.in

2.https://www.gale.com

Programme: B.Sc., **Subject**: Chemistry

Semester: VI **Course:** Organic Chemistry III

Course Type: Part – III / Core XI **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Assessing the NMR Spectroscopy and brief discussion of Fourier transform resonance Spectroscopy	Evaluation (Level 5)
Evaluating the properties and structure of Heterocyclic compounds	Evaluation (Level 5)
Identifying the naming reaction	Analysis (Level 4)
Doing the basic classification and role of alkaloids and to learn the structural elucidation and degradation of alkaloids	Application (Level 3)
Understanding the terpenoids and its classification	Comprehension (Level 2)

COURSE CONTENT

UNIT – I

a) Application of spectroscopy to organic molecules – theory and applications of spectroscopic methods – electromagnetic spectrum – the UV spectrum – I dentificationofconjugation – woodwardFieser Rule – adsorption maxima.

b)IR Spectrum – functional group detection, finger print region – study in Hydrogen bonds.c)NMR Spectrum – no of signals – equivalent and non-equivalent protons- chemical shife –peak area ands proton counting – splitting of signals – spin-spin couopling.

UNIT – II

a)Tautomerism: Definition – condition of Tautomerism – prototropy and Anisotropy – types ofTautomerism.

i) Keto – enoltautomerism

ii) Nitro-acinitrotautomerism

iii) Nitro-isonitrotautomerism

iv) Lactam – lactimtautomerism and

v) Quinonemonoxime – p-nitrophenol

b)FREE RADICALS: Definition – preparation and reactions of short lived and long lived free radical – stability of free radicals – Role of free radicals in Chain reaction. Organic photochemistry – [hotochemical reactions of olefins, Cis–trans isomerism and dimerisation.

UNIT – III

MOLECULAR REARRANGEMENTS: Detailed mechanisms of the following reactions,Pinacol – Pinacolone , Hofmann Curtius, Benzillic acid, Claisen, Benzidine, Beckmann, Friesand Wagner – Meerwing rearrangements.

UNIT-IV

Heterocyclic compounds containing one hetero atom. Preparation and properties, structure ofpyrrole, furan, thiophene, indole, pyridine, quinoline, and isoquinoline.

UNIT – V

a)Alkaloids: Definition, occurrence, extraction of alkaloids and general methods for determining the structure of alkaloids – Classification of alkaloids - structure and synthesis of the following alkaloids : Cocaine, papaverine, pipperine and nicotine.

b)Terpenoids: Indroduction, classification occurrence, isolation – general properties – isoprene rule – General methods of determining structure, Synthesis – properties – ofcitral, geraniol, terpeinol

Books for Study

1.R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992.

2. B. Y. Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc.(Singapore), New Delhi, reprint, 2002.

Books for Reference

1. T. W. Graham Solomons, Organic Chemistry, 6th edition, John Wiley and sons, 1996.

2. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley And Sons, New York,1992.

3. S. H. Pine, Organic Chemistry, 5th Edition, Mcgraw Hill International Edition, Chemistry Series, New York, 1987.

4.Sehan. N. Ege, Organic Chemistry, Structure And Reactivity, 3rd Edition, A.I.T.B.S., New Delhi, 1998.

Online Resources:

1. https://masterorganicchemistry.com

2.https://quora.com

Programme: B.Sc., **Subject**: Chemistry

Semester: VI **Course:** Physical Chemistry II

Course Type: Part – III/ Core XII **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Understanding the concept of Ionic activity and Ionic strength	Comprehension (Level 2)
Deriving Nernst equation and redox system	Analysis (Level 4)
Gaining knowledge of Laws of photochemistry	Knowledge (Level 1)
Analysing Photochemical excitation and Jablonski diagram	Analysis (Level 4)
Evaluating the f Debye Huckel rule, limitations and its applications	Evaluation (Level 5)

COURSE CONTENT

UNIT – I

Photochemistry: Photochemical reactions – definition – comparative study of thermal and photochemical reactions – laws of photochemistry: Lambert and Beeer's laws, Grotthus – Drapper law, Stark-Einstein law – quantum efficiency and its determination – consequences of light.

Absorption by atoms and molecules – photophysical processes-fluorescencephosphorescence and other deactivating processes. Jablonskii diagram.

Photochemical processes: Kinetics of photochemical reactions.

i) Gaseous reactions: Hydrogen-chlorine reaction, decomposition of HBr, HI and photolysis of ammonia.

ii) Reactions in liquid phase (solutions) – isomeric transformation ofmaleic tofumaric acid – polymerization of anthracene.

iii) Photochemical equilibrium – flash photolysis – photosensitization – chemiluminescence.

iv) Radiation chemistry – application

UNIT – II

Electrochemistry – I

Conductance:

Definition and determination – specific, equivalent conductance with dilution and its limiting values.

Strong and weak electrolytes: theory of strong electrolytes – Debye-Huckel-Onsager equation (no derivation) ionic activity and activity co-efficient

Ostwald's dilution law and its applications

Kohlrausch's law of ionic mobilities and its applications.

Absolute velocity of ions and its determination – Transport number of ions and their determination.

Applications of conductivity measurements – degree of dissociation – solubility of a sparingly soluble salt – degree of hydrolysis – basicity of acids – conductometric titrations.

UNIT-III

Electro Chemistry –II

Ionic Equilibria:

a) Common ion effect and solubility product – quantitative study and their applications.

Hydrolysis – degree of hydrolysis (∞) – hydrolysis constant (Kh) – their experimental determination and derivation of these values for different salt solutions – based onKw, Ka and Kb calculation involving hydrolytic constants. pH of solutions – definition and methods of determination of pH

Buffer solution - definition – theory of buffer action and applications – Henderson equation.

UNIT – IV

Electrochemistry – III

Electrode potentials and electrochemical cells.

Single electrode potentials – oxidation and reduction potentials

Thermodynamics and electromotive force (emf) – relation between chemical and electrical energies – calculation of G, S, and H of cell reaction. Calculation of emf. Nernst equation – standard electrode potential and its characteristics.

Types of electrodes: metal – metal ion, gas, metal – insoluble salt, redox, glass electrodes.

Chemical and voltaic cells: Definition – cell reaction and representations of electrodes and cells – emf of cell – conventions regarding signs of emf – calculation of cell emf from single electrode potentials. Calculation of cell emf with the aid of Nernst equation. Experimental determination of emf of cells.Measurement of single electrode potentials –chemical cells with and without transference – liquid junction potential and salt bridge.

Concentration cells: Definition and calculation of emf – types of concentration cells – concentration cells with and without transference – determination of activity coefficient of electrolytes.

UNIT – V

Commercial cells: Primary and secondary cells – Weston Cadmium cell, lead storage cell, Ni-Cd cell, fuel cell.

a) Applications of emf measurements.

b) Determination of solubility and solubility product of sparingly soluble salts.

c) Determination of pH – using Hydrogen electrode, glass electrode, quinhydrone electrode.

d) Determination of valency of ion.

e) Potentiometer titrations – acid-base, redox, precipitation and complexometric titrations.

f) Determination of transport number.

Electrolysis and polarization: Over voltage, decomposition potential, hydrogen over voltage.

Books for study:

1.S.H. Maron and J.B. Lando, Fundamentals of physical chemistry, Macmillan limited, New York, 1966.

2. B.R. Puri and L.R. Sharma, Principles of physical chemistry, ShobanLalNaginChand and Co. 33rd edition, 1992.

Book for References:

1. S.K. Dogra and S. Dogra, Physical chemistry through problems, New age international, 4 th edition 1996.

2. Gilbert. W. Castellan, Physical chemistry, Narosa publishing house, third edition 1985.

3. P.W. Atkins, Physical chemistry, Oxford university press, 1978.

4. K. L. Kapoor, A textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd, 1994.

Online Resources:

1. https://global.oup.com

2. htttps://global.com

Programme: B.Sc., **Subject**: Chemistry

Semester: VI **Course:** Industrial Chemistry

Course Type: Part – III/ Core XIII **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	**Bloom's Taxonomy level**
Gaining knowledge on fertilizer and their types	Knowledge (Level 1)
Understanding the manufacture and types of paints	Comprehension (Level 2)
Assessing the process of corrosion and their prevention	Evaluation (Level 5)
Describing the raw material and preparation of match boxes.	Analysis (Level 4)
Applying the knowledge to photography	Application (Level 3)

COURSE CONTENT

UNIT – I

a) Fertilizers: Definition - Nutrients for plants – Role of various elements in plant growth – natural and chemical fertilizers – classification of chemical fertilizers – Urea, super phosphate and potassium nitrate – Mixed fertilizer – Fertilizer Industry in India.

b) Match Industry, pyrotechny and explosives: Raw materials needed for match industry – manufacturing process – pyrotechnics – coloured smokes – Explosives; Definition – classification – Nitroglycerine, dynamite, cordite, TNT and picric acid.

UNIT – II

a) Silicate Industry: Cement, Glass and ceramics. Raw materials and manufacture of cement, Glass and ceramics.

b) Petrochemicals: Elementary study – Definition – origin – composition – chemicals from natural gas, petroleum, Light Naphtha and Kerosene – synthetic gas.

UNIT –III

a) Corrosion of metals: Definition – various methods of preventing corrosion – coating with other metals (galvanizing, lining, and electroplating) – cathodic protection and painting – corrosion inhibitors.

b) Photography: Colour photography

UNIT – IV

Chemistry of paper Industry: Raw materials manufacturing process – bleaching and colorings.

UNIT – V

Paints:

Manufacture – setting – characteristics of good paint, failure, varnish – types.

Books for study:

1.Norrisshreve, R. and Joseph A. Chemical process industries, 4th ed.; Mc Graw – Hill Kogakusha, ltd: 1977.

2. George T. Austin. Shreve's chemical process industries, 5th ed.; Mc Graw – Hill: 1984.

Books for Reference

1. Subbarao, N. S. Biofertilizers in agriculture; oxford and IBH publishing co.: New delhi, 1982.

2. Jain, P. C. and Jain, M. Engineering chemistry, 10th ed.; DhanpatRai and sons: delhi, 1993

Online Resources:

1. https://global.oup.com
2. htttps://global.com

Programme: B.Sc., **Subject**: chemistry

Semester: VI **Course:** Physical Chemistry Experiments

Course Type: Part – III/ Core Practical III **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	**Bloom's Taxonomy level**
Assessing thermodynamics of simple systems	Evaluation (Level 5)
Designing and performing experiments to determine the rate, order, and activation energy of chemical reactions by varying concentrations and/or temperature	Synthesis (Level 6)
Understanding the safety requirements and lab skills to perform physico-chemical experiments	Comprehension (Level 2)
Analyzing the dissociation constant and solubility product by conductometry and potentiometry respectively	Analysis (Level 4)
Demonstrating the practical working out of chemical processes and reactions to the public	Synthesis (Level 6)

COURSE CONTENT

Determination of Kf of a solute by Rast method (cryoscopy)

Determination of molecular weight of a solute by Rast method

Simple eutectic phase diagram, Compound formation

Determination of CST of phenol-water system study of effect of impurities on CST

Determination of Partition coefficient of iodine in CCl4 and water system

Determination of equilibrium constant of KI+I2 KI3 system. Determination of strength of potassium iodide

Determination of rate constant of a first order reaction -ester hydrolysis

Comparison of strengths of two acids by ester hydrolysis method

Conductivity titration between an acid and a base

Books for study

1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.

Books for Reference

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt.,

1996.

2. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edi., McGraw- Hill Book company, 1989.

Online Resources:

1. https://people.ok.ubc.ca/pphillips/DRAFT%20464%20Manual.pdf

2. https://pubs.acs.org/doi/abs/10.1021/ed013p250.2

Programme: B.Sc., **Subject**: chemistry

Course Type: Part – III/ Core Practical IV **Course:** Gravimetric Estimation & Organic Preparation

Semester: VI **Credits:** 4

Hours Required: 5 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	Bloom's Taxonomy level
Gaining knowledge on the volumetric and gravimetric analysis of cations and anions.	Knowledge (Level 1)
Applying the results of scientific experiments in oral reports and written reports to the life	Application (Level 3)
Predicting the outcome and mechanism of some simple organic reactions, using a basic understanding of the relative reactivity of functional groups	Evaluation (Level 5)
Understanding technical literature related to the discipline	Comprehension (Level 2)
Assessing to maintain high standards of professional and scientific ethics	Evaluation (Level 5)

COURSE CONTENT

Gravimetric Analysis

Estimation of Ca as calcium oxalate monohydrate

Estimation of Ba as chromate

Estimation of Lead as Chromate

Organic Preparation:

Preparation involving

Hydrolysis – Ester hydrolysis

Amide hydrolysis

Benzoylation of beta naphthol amines

Acetylation of an amine

Nitration of acetanilide

Oxidation: Benzoic acid from benzaldehyde

Book for study:

1.Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.

Book for Reference

1. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edi., ELBS/Longman England, 1989

Online Resources:

1. https://www.khanacademy.org

2. https://jordilabs.com

Programme: B.Sc., **Subject**: Chemistry

Semester: VI **Course:** Nano science and Technology

Course Type: Part – III/ Elective-IV **Credits:** 3

Hours Required: 3 Hrs / Week

CIA: 25 **CA:** 75

Course outcomes:

Description	**Bloom's Taxonomy level**
Gaining knowledge on the definition of a nano system and the basic concepts of nanoscience and technology	Knowledge (Level 1)
Understanding the scientific revolutions of nanotechnology	Comprehension (Level 2)
Comprehending the concepts of nanoscience and technology and commercial applications of Nanotechnology	Comprehension (Level 2)
Predicting the Classification of nanostructures, size dependency in nanostructures and quantum size effects in nanostructures	Evaluation (Level 5)
Evaluating the study of Applications of metal nanoparticles in technologically imperative fields	Evaluation (Level 5)

COURSE CONTENT

UNIT-I

Introduction – nanochemistry, nanotechnology, nanoproperties, nanotubes, nanowires characterization – application -fullerenes – purification -properties -optical properties.

UNIT-II

Carbon nanotubes – synthesis and purification -filling of nanotubes mechanism of growth – transport properties – mechanical properties – physical properties – application of carbon nanotubes.

UNIT-III

Core-shell nanoparticles -types of system – properties – application of core shell nanoparticles– monolayer protected metal nanoparticles method of preparation – functional metal nano particles – applications

UNIT- IV

Nanosensors –nanoscale organization for sensors – nanosensors on optical properties – physical properties – nanobiosensors – sensors of the future nanoshells – types of nanoshells – properties -applications.

UNIT-V

Nanomedicines – various kinds of nano system in use – protocols for nanodrug administration – nanotechnology in diagnostic application. Use of gold nano- particles in diagnostic and therapeutic application molecular nanomechines -covalent and non covalent approaches molecular motors and machines – molecular devices – practical problems with molecular devices.

Text Book:

1. T. Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnology, McGraw-Hill Professional Publishing, 2008.

Book for Reference

1. J. Dutta, H.F. Tibbals and G.L. Hornyak, Introduction toNanoscience, CRC press, Boca Raton, 2008.

Online Resources:

1. https://folk.ntnu.no
2. https://pubs.rsc.org

Programme: B.Sc., **Subject**: Chemistry

Semester: VI **Course Type:** Textile Chemistry

Part – IV/ SBE – IV **Credits:** 2

Hours Required: 2 Hrs / Week **CIA:** 25

CA: 75

Course outcomes:

Description	**Bloom's Taxonomy level**
Gaining knowledge on basic printing Process	Knowledge (Level 1)
Understanding the pre-treatment of dying	Comprehension (Level 2)
Applying Printing technique to textile process	Application (Level 3)
Predicting the Classification of fibres	Evaluation (Level 5)
Evaluating the study of Applications of printing	Evaluation (Level 5)

COURSE CONTENT

UNIT – I

Natural Fibre: properties of textile fibres – classification of fibres. Natural fibres of vegetables origin – chemical and physical properties of cotton, jute. Natural fibres of animal origin: chemical and physical properties of wool and silk – natural mineral fibres: chemical and physical properties of asbestos and glass.

UNIT – II

Man madefibre: mode of production – types of spinning – wet dry and melt spinning.

a. viscose rayon: Raw material, method of conversion to fibre and filament form. Physical and chemical properties and uses.

b. Cuprammoniumrayon and cellulose acetate: raw materials, method of conversion to fibre and filament form. Physical and chemical properties and uses.

c.Synthetic organic fibre: polyamide and polyester fibre – raw materials, methodof production, physical and chemical properties fibre structure.

UNIT – III

Pre – treatment process for dyeing:

Study of operation, principles and different agent for singeing, desizing, scouring and bleaching.

UNIT – IV

Dyeing: classification of dyes – theories of dyeing

Direct dye: properties, method of application to cotton – assistants used and their functions.

Sulphur dye: properties, method of application to cotton. Acid dye: properties, method ofapplication to cotton.

Vat dye: properties, method of application to cotton.

UNIT – V

Printing: different methods of printing like hand block printing, stencil printing, wax printing, screen printing, roller printing etc.

Text Books:

1.Venkatraman.K., "The Chemistry of Synthetic Dyes" – Vol. I & II, Academic press, London, 1990 .

Book for Reference

1. David. R. Waring, Geoffrey Hallas, The Chemistry and Application of Dyes, SDC,1990

Online Resources:

1. www.cs.arizona.edu

2. www.myklassrom.com