


B. Sc., Chemistry

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;"> <p>GOVERNMENT ARTS COLLEGE (Autonomous Institution & Accredited by NAAC with 'A' Grade) P.G. and RESEARCH DEPARTMENT OF CHEMISTRY COIMBATORE – 641 018, INDIA B.Sc. Degree Program in Chemistry (For the students admitted during the academic year 2018-2019 and onwards)</p> </div> <div style="text-align: right;"> <p>Annexure –7</p> </div> </div>												
UG - SCHEME OF EXAMINATIONS : CBCS PATTERN												
Semester	S.No	Subject Code	Part	Subject	Hrs/week	Exam (Hrs)	Marks					No. of Credits
							External mark	Internal mark	Total	External Passing Minimum.	Total passing minimum	
I	1	18TAM11L	I	Language I-Tamil – I	6	3	75	25	100	30	40	3
	2	18ENG12L	II	Language II-English – I	6	3	75	25	100	30	40	3
	3	18BCH13C	III	Core-I:General Chemistry– I	5	3	75	25	100	30	40	4
	4	18BCH14A	III	Allied 1- Mathematics – I	8	3	75	25	100	30	40	5
	5	-	III	Core Practical-I Inorganic Qualitative Analysis	3							
	6	18ENV1GE	IV	Environmental Studies	2	3	75	25	100	30	40	2
II	1	18TAM21L	I	Language I - Tamil – II	6	3	75	25	100	30	40	3
	2	18ENG22L	II	Language II - English – II	6	3	75	25	100	30	40	3
	3	18BCH23C	III	Core-II: General Chemistry–II	5	3	75	25	100	30	40	4
	4	18BCH24A	III	Allied 2- Mathematics – II	8	3	75	25	100	30	40	5
	5	18BCH25P	III	Core Practical I - Inorganic Qualitative Analysis	3	3	60	40	100	24	40	5
	6	18VAL2GE	IV	Value Education Gandhian Thoughts	2	3	75	25	100	30	40	2
Total					60				1100			39

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III	1	18TAM31L	I	Language I - Tamil – III	6	3	75	25	100	30	40	3
	2	18ENG32L	II	Language II - English – III	6	3	75	25	100	30	40	3
	3	18BCH33C	III	Core-III:General Chemistry – III	4	3	75	25	100	30	40	4
	4	18BCH34A	III	Allied 3 - Physics – I	5	3	60	15	75	24	30	3
	5	-	III	Allied Physics Practical	3	--	--	--	--	--	--	--
	6	-	III	Core Practical-II: Inorganic Volumetric and Organic Qualitative Analysis	3	--						
	7	18BCH35S	IV	Skill Based Elective I Polymer Chemistry	3	3	75	25	100	30	40	3
IV	I	18TAM41L	I	Language I - Tamil – IV	6	3	75	25	100	30	40	3
	2	18ENG42L	II	Language II - English – IV	6	3	75	25	100	30	40	3
	3	18BCH43C	III	Core-IV: General Chemistry – IV	4	3	75	25	100	30	40	4
	4	18BCH44A	III	Allied 4 -Physics – II	5	3	60	15	75	24	30	3
	5	18BCH45P	III	Allied Physics Practical.	3	3	30	20	50	12	20	4
	6	18BCH46P	III	Core Practical- II: Inorganic Volumetric and Organic Qualitative Analysis	3	6	60	40	100	24	40	5
	7	18BCH47S	IV	Skill Based Elective - II Pharmaceutical Chemistry	3	3	75	25	100	30	40	3
	8	18EXA4GE	V	Extension activities NCC/NSS/YRC/PEd								1
Total					60				1100			42
V	1	18BCH51C	III	Core V-Theoretical Chemistry	5	3	75	25	100	30	40	4

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	2	18BCH52C	III	Core VI - Organic Chemistry – I	5	3	75	25	100	30	40	4
	3	18BCH53C	III	Core VII - Physical Chemistry – I	5	3	75	25	100	30	40	4
	4	18BCH54S	IV	SkillBased ElectiveIII:Textile Chemistry	4	3	75	25	100	30	40	3
	5	18BCH5EL	IV	Non major Elective-I:Chemistry in Changing Life Style – I	3	3	75	25	100	30	40	2
	6	-	III	Core Practical III: Inorganic Gravimetric Estimation and preparation	3	--						
	7	-	III	Core Practical IV: Physical Chemistry Practicals	3	--						
	8	-	III	Core Practical V: Application Oriented Practicals	2							
	9	-	III	Project	-							
	VI	1	18BCH61C	III	Core VIII - Inorganic Chemistry	5	3	75	25	100	30	40
2		18BCH62C	III	Core IX - Organic Chemistry – II	5	3	75	25	100	30	40	4
3		18BCH63C	III	Core X Physical Chemistry – II	5	3	75	25	100	30	40	4
4		18BCH67S	IV	SkillBasedElective-IV Industrial Chemistry	4	3	75	25	100	30	40	3
5		18BCH6EL	IV	Non major ElectiveII: Chemistry in Changing Life Style –II	3	3	75	25	100	30	40	2
6		18BCH64P	III	Core Practical III: Inorganic Gravimetric Estimation and preparation	3	3	60	40	100	24	40	3
7		18BCH65P	III	Core Practical IV: Physical Chemistry	3	3	60	40	100	24	40	3
8		18BCH66P	III	Core Practical V: Application Oriented Practicals	2	3	60	40	100	24	40	4
9		18BCH68V	III	Project with Viva Voce.			80	20	100	32	40	15
Total					60			1400			59	

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Annexure 10

Credit and Marks Details for UG with effect from 2018-2019

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SUMMARY :Credit and Total Marks

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Part	Subject	No. of Papers	Credit	Total Credits	Marks	Total Marks
I	Language I: Tamil	04	03	12	100	400
II	Language II: English	04	03	12	100	400
III	Core	10	04	40	100	1000
III	Allied Maths	02	05	10	100	200
III	Allied Physics	02	03	06	75	200
		Practical 01	04	04	50	
III	Core Practical	05 (02 + 02+01)	- 5+3+4	20	100	500
III	Project	01	15	15	100	100
IV	Skill Based Elective	04	03	12	100	400
IV	Non-Major Elective	02	02	04	100	200
IV	Environmental Studies	01	02	02	100	200
	Value Education	01	02	02	100	
V	Extension Activities	01	01	01	---	---
Total		38	---	140	---	3600

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Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	Paper – I: GENERAL CHEMISTRY – I (Inorganic, Organic & Physical Chemistry)	I	05	18BCH13C

Unit – I

Macro, micro, semi-micro and ultra micro methods - Semi-micro qualitative analysis for inorganic anions and cations (pertaining to B.Sc. practical syllabus only). Dry and wet Tests, sodium carbonate extract tests, confirmation test for anions –general group separation and individual group analysis.

Unit – II

Compounds of rare gases – preparation properties structure and uses of XeF₂, XeF₄, XeF₆. Interhalogen compounds: ICl, BrF₃, IF₅, and IF₇ - preparation, properties, structure and uses. Ozone and hydrogen peroxide – Preparation, properties, structure and uses. Comparison between ozone and hydrogen peroxide. Oxyacids of sulphur – Caro's acid and Marshall's acid.

Unit – III

Theoretical principle: The breaking & forming of bonds – homolytic & heterolytic fission – generation, structure and stability of carbocations, carbanions and free radicals . Classification of reagents - Electrophiles, Nucleophiles and Free radicals. Types of organic reactions – displacement or substitution, addition, elimination and rearrangement. Polar effects – inductive effects and field effects (of acids & bases) mesomeric (conjugation) effects, hyperconjugation, steric effects (ortho effect, steric hindrance and steric inhibition of resonance) and their effects on reactivity of simple organic compounds.

Unit – IV

Isomerism in organic compounds: General classification – structural isomerism – types – explanation with examples.–Aliphatic hydro carbons – Bayer's strain theory. Conformational analysis of ethane, 1,2-dichloroethane, n-butane and cyclohexane. Hydrocarbons – classification and nomenclature – open chain, cyclic, aliphatic, aromatic, saturated, unsaturated, polycyclic hydrocarbons.

Unit – V

Thermodynamics: Zeroth law of Thermodynamics – Absolute Temperature scale – Extensive and Intensive Properties. Internal energy (E), Enthalpy (H), Cp & Cv and their relationship. First law of Thermodynamics – internal energy, enthalpy, heat and work done - calculations work done in isothermal and adiabatic reversible and irreversible processes for ideal gases. Joule – Thompson effect – Joule Thompson Coefficient for ideal and real gases – Inversion Temperature.

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TEXT BOOKS / REFERENCES

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
2. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).
3. Gurdeep Raj, Advanced Physical Chemistry, Krishna Prakash, 3rd Ed. (2006).
4. Samuel Glasstone, Thermodynamics for Chemists, East West press, (2008).
5. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand, New Delhi, (2008).
6. P.L. Soni, O.P. Dharmarha, Text Book of Physical Chemistry, Sultan Chand & Sons, New Delhi, 5th Edn., (1972).
7. R.T. Morrison, R.N. Boyd, Organic Chemistry Prentice Hall of India (P) Ltd., New Delhi, 2nd Edition (1974).
8. I.L. Finar, Organic Chemistry, Volume 1, Longman Scientific & Technical (2000)
9. J. March, Advance Organic Chemistry, John Wiley & Sons, Asia, New Delhi, 4th Edn., (2008).
10. P.L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, (2011).
11. O.D. Tyagi, M. Yadav, A Text Book of Reaction Mechanism, Anmol Publication Ltd., New Delhi, 1st Edn., (2002).
12. Satyaprakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry, S. Chand & Co., Ltd., New Delhi, 16th Revised Edn., (1985).
13. R.D. Madan, Inorganic Chemistry, S. Chand, 3rd ed. (2014).
14. B.R. Puri, L.R. Sharma, Inorganic Chemistry, Miestone revised edition (2011).
15. J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).
16. P.B. Janarthanan, B. Sivakumar, Textbook of Inorganic Chemistry., Mohan Brimlani, Oxford & IBH Publishing Co., New Delhi, Copyright (1978).
17. F.W. Fifiield, D. Kealy, Principles and Practice of Analytical Chemistry, Chapman & Hall Publishers, New York, 5th Edn., (2000).

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Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	Paper –II: GENERAL CHEMISTRY – II (Inorganic, Organic & Physical Chemistry)	II	05	18BCH23C

Unit – I

Purification Techniques: Distillation – Vacuum, Fractional, Steam & Azeotropic. Crystallization & Sublimation: Principles & Techniques with suitable examples.

General Methods of Extraction of Metals: Ore dressing – froth floatation, gravity, magnetic & chemical separation. Extraction of Metals – Electrolytic reduction, Chemical reduction, Metal displacement & Complex formation. Refining of Metal – Electrolysis, Van-Arkel process, Zone refining.

Unit – II

Physical properties of alkali metals, Electronic structure, Density, Atomic volume, Atomic & Ionic radii, Ionization energy & Electronegativity.

A comparative study of reactions of Alkali metals with Oxygen, Hydrogen, Halogen & Water. Difference between Lithium & other Alkali metals. Diagonal relationship between Lithium and Magnesium. Extraction of Lithium & Sodium.

Alkaline Earth Metals: Beryllium, Barium & Radium: Extraction, Properties & Uses.

Unit – III

Alkenes: General Methods of Preparation, Properties & Reactions: Preparation involving (i) Dehydration, Dehalogenation and dehydrohalogenation (ii) Reduction involving alkynes, Wittig reaction.

Reaction of alkenes: General Addition and Substitution Reactions – Hydroborations, Ozonolysis and Allylic substitution.

Elimination Reactions: *cis* and *trans* - Eliminations – Mechanisms of Eliminations: E1 and E2 – Hofmann's & Saytzeff's Rule.

Dienes – Types with suitable examples-Stabilities of isolated & conjugated dienes 1,2 and 1,4 – additions – Addition of HBr to butadiene – Diel's Alder Reaction.

Unit – IV

Alkynes: General Methods of Preparation, Properties and Reactions of Metal acetylides, Acidity of Alkynes.

Benzene and aromaticity: Resonance energy of Benzene, Huckel's rule – Aromaticity in cyclopropenyl cation, cyclopentadienyl anion and tropylium cation. Aromatic Electrophilic Substitution Reactions: arenium ion mechanism and typical reactions of benzene: Nitration, Sulphonation, Halogenation, Friedel Craft's alkylation, acylation and their Mechanism. Orientation and reactivity in mono substituted benzene.

Unit – V

Hess' Law of Constant Heat Summation and its applications in the calculation of enthalpy of reactions, formation, and combustions. Bomb Calorimeter – Bond Energies, and their applications in the determination of enthalpy of reactions, formation and resonance energies of an ideal gas.

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Introduction to Second Law of Thermodynamics – Need for Second Law – Various statements of Second Law – Carnot cycle. Concept of Entropy (S) – units – Entropy change of an ideal gas in reversible and irreversible processes. Entropy changes accompanying change of phase – Trouton's Rule. Calculation of Entropy Changes (ΔS) of an ideal gas with changes in P, V, and T. Entropy Changes of an ideal gas in different processes. Physical significance of entropy.

TEXT BOOKS / REFERENCES

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
2. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).
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5. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand, New Delhi, (2008).
6. P.L. Soni, O.P. Dharmarha, Text Book of Physical Chemistry, Sultan Chand & Sons, New Delhi, 5th Edn., (1972).
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9. J. March, Advance Organic Chemistry, John Wiley & Sons, Asia, New Delhi, 4th Edn., (2008).
10. P.L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, (2011).
11. O.D. Tyagi, M. Yadav, A Text Book of Reaction Mechanism, Anmol Publication Ltd., New Delhi, 1st Edn., (2002).
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15. J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).
16. P.B. Janarthanan, B. Sivakumar, Textbook of Inorganic Chemistry., Mohan Brimlani, Oxford & IBH Publishing Co., New Delhi, Copyright (1978).
17. F.W. Fifield, D. Kealy, Principles and Practice of Analytical Chemistry, Chapman & Hall Publishers, New York, 5th Edn., (2000).

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Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	Paper – III: GENERAL CHEMISTRY – III (Inorganic, Organic & Physical Chemistry)	III	04	18BCH33C

Unit – I

Separation techniques- general principles of separation by precipitation, solvent extraction, chromatography – Basic principles and applications of Paper, Thin layer, Column, Gas-liquid and Ion-exchange.

Principles of Volumetric Analysis: concentration terms: molarity, molality, normality, mole fraction, percentage and related problems - Acid – base, Redox, and Complexometric Titrations – Theory and Principles. Role of indicators.

Principles of Gravimetric Analysis: Conditions, Choice and Selectivity of Precipitants – Sequestering agents – Solubility Product Principle and Applications; co- and Post Precipitations

Unit – II

Chemistry of Boron Family: Group discussion – Electron Acceptor Behavior and Electron deficiency of Boron hydrides, Bonding in Diboranes- Boron nitride (diamond and graphite forms) – Borozoles- Sodium per borate-preparation and uses.

Classifications of Silicates – Simple, chain and sheet silicates only.

Unit – III

Preparation and Properties of Aldehydes: Formaldehyde, Acetaldehyde and Benzaldehyde (from Toluene). Nucleophilic Addition Reactions of Carbonyl Compounds: Addition of HCN, NaHSO₃, and RMgX. – Reactions with NH₃, NH₂OH, N₂H₄ and Semicarbazide.

Condensation Reactions: Aldol, Perkin, Knoevenagel, Claisen, Dieckmann and Benzoin Condensations. Cannizzaro, Reformatsky and Haloform Reactions.

Reduction Reactions: Reaction and mechanism of Wolff-Kishner, Meerwin Ponderoff Verley- Applications of reducing reagents like LiAlH₄ & NaBH₄.

Unit-IV

Nucleophilic Substitution Reactions: Mechanisms of SN₁, SN₂, SNi and NGP Reactions – Effects of substrate, solvent, nucleophile and leaving group..

Thermodynamics: Definition of Helmholtz Free Energy (A) Gibb's Free Energy (G): Variation of Free Energy with Temperature and Pressure – Thermodynamic Equation of States – The General Condition of equilibrium and Spontaneity. Gibbs – Helmholtz Equation.

Unit-V

Partial Molar Functions – Concepts of Chemical Potential ($\Delta\mu$): Gibb's Duhem Equation and its Application - Chemical Potential for Ideal gases. Variation of $\Delta\mu$ with T and P. Clapeyron Equation, Clasius – Clapeyron Equation: Derivations and their Applications. Activity, fugacity and activity coefficient (definition only).

Law of Mass Action: Derivation of K_p and K_c and their relationship – Le Chatelier–Braun Principle – Thermodynamic Interpretation – Application to homogeneous and Heterogeneous Equilibria. Vont Hoff isotherm and isochore.

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TEXT BOOKS / REFERENCES

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
2. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).
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10. T. W. graham solomons, Organic chemistry, Wiley, 4th ed. (2010).
11. P.L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, (2011).
12. O.D. Tyagi, M. Yadav, A Text Book of Reaction Mechanism, Anmol Publication Ltd., New Delhi, 1st Edn., (2002).
13. Satyaprakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry, S. Chand & Co., Ltd., New Delhi, 16th Revised Edn., (1985).
14. B.R. Puri, L.R. Sharma, Inorganic Chemistry, Miestone revised edition (2011).
15. J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).
16. P.B. Janarthanan, B. Sivakumar, Textbook of Inorganic Chemistry., Mohan Brimlani, Oxford & IBH Publishing Co., New Delhi, Copyright (1978).
17. R.D. Madan, Inorganic Chemistry, S. Chand, 3rd ed. (2014).
18. F.W. Fifield, D. Kealy, Principles and Practice of Analytical Chemistry, Chapman & Hall Publishers, New York, 5th Edn., (2000).
19. V.K. Srivastava, K.K. Srivastava, K.K. Kishore, Introduction to Chromatography – Theory & Practice, S. Chand & Co. (P) Ltd., New Delhi, 3rd Edn., (1987).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Skill Based Elective-I: POLYMER CHEMISTRY	III	03	18BCH36S

Unit I

Basic Concepts: monomer, polymer, degree of polymerization - Classification of polymers – natural and synthetic polymers with examples.

Addition Polymerization: Free-radical polymerization: Initiation, propagation and termination reactions involving vinyl monomers – propylene and styrene with any two free-radical catalysts. Cationic polymerization: Initiation, propagation and termination reactions involving $\text{BF}_3 \cdot \text{H}_2\text{O}$ catalyst with isobutylene monomer. Anionic polymerization: Initiation, propagation and termination reactions involving KNH_2 with styrene monomer.

Unit II

Coordination polymerization – Ziegler-Natta catalysts – monometallic and bimetallic mechanism.

Condensation Polymerization: Basic principles of condensation polymerization. General reactions with examples for the formation of polyamides, polyesters and polycarbonates.

Molecular weight – weight average, number average, viscosity average. Methods of determination – end group analysis, osmometry and viscometry.

Unit III

Copolymerization: Importance and types. Monomer reactivity ratios and their importance. Types of copolymers: alternate copolymers, random copolymers, block copolymers and graft copolymers (two examples each with copolymer structures). Typical polymers: preparation and uses of Teflon, polyethylene and Bakelite.

Unit IV

Methods of Polymerization: Basic principles and comparisons of polymerization techniques – Bulk polymerization, solution polymerization, suspension polymerization and emulsion polymerization-melt, solution and interfacial polymerization.

Testing of polymers - melting point and glass transition temperature.

Unit V

Processing of Polymers: Additives for polymers: Fillers, colourants, plasticisers, antioxidants and flame retarders. Moulding techniques - blow moulding, compression molding, transfer molding, extrusion molding and injection moulding.- Film and sheet formation. Polymer Nanocomposites –definition - Photoresist applications of nanocomposites.

TEXT BOOKS / REFERENCES

1. V. R. Gowarikar, Polymer Science, New Age, 3rd ed. (2009).
2. Gosh, Polymer Science, TMH, 4th ed. (2010).
3. Malcom. P. Stevens, Polymer Chemistry, Oxford, 3rd ed. (2011).
4. J. R. Friel, Polymer Science and Technology, Pearson, 2nd ed. (2005).

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5. S.K. Bhasin, Rekha Mann, Introductory Polymer Science, Dhanpat Rai Publishing Company, New Delhi (2003).
6. R.B. Seymour, Introduction to Polymer Chemistry, McGraw Hill Kogakush Ltd., New Delhi, (1971).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Paper – IV: GENERAL CHEMISTRY – IV (Inorganic, Organic & Physical Chemistry)	IV	04	18BCH43C

Unit – I

The nature of Cohesive forces in liquids and solids.

Liquid crystals: The concept of mesomorphic state – typical liquid crystalline substances. Classifications – Smectic, Nematic, Cholesteric Properties – molecular arrangements and applications.

Amorphous and Crystalline Solids – Differences – Isotropy – Anisotropy. The Symmetry in Crystals-Bravais lattices. – Laws of Rational indices – Miller indices, X-ray studies of crystal -Bragg's Equation . Imperfections in Crystals – Point defects – Stoichiometric-Schotky and Frenkel defects and Non-stoichiometric defects-metal excess defects (colour centre)and metal deficiency defects.

Unit – II

Zinc and copper – Extraction, Properties and uses. Compounds of Zn (II) – ZnO, ZnCl₂, - Preparation, Properties and Uses. Alloys of Cu- Brass, bronze, monel metal

Elements of Group VIII: Co and Ni.- Extraction, Properties and Uses. Alloys of Co and Ni

Platinum – Extraction and Uses. Compounds of Pt – PtCl₄, H₂PtCl₆.

Unit – III

Aromatic acids - preparation, properties of benzoic acid, benzenesulphonic acid and p-toluene sulphonic acid.

Aliphatic dicarboxylic acids: preparation and properties of oxalic acid, malonic acid and succinic acid and adipic acid.

Aromatic dicarboxylic acid: Preparation and properties of phthalic acid and isophthalic acid. Active methylene compounds – malonic ester, acetoacetic ester- their synthetic applications. Tautomerism in acetoacetic ester.

Unit – IV

Colligative properties of Dilute Solutions: Osmosis and Osmotic Pressure. Theories of semipermeability – Reverse Osmosis – Determination of Elevation of Boiling Point and Depression in Freezing Point – Van't Hoff Factor – Degree of association and Degree of dissociation.

Third law of Thermodynamics – Need for Third Law – Nernst Heat Theorem – Limitations of Nernst Heat Theorem – Contribution of Richards and Planck – Determination of Absolute Entropies of Solids, Liquids and Gases. Exceptions to Third Law.

Distribution Law: Thermodynamic Derivation. Nernst Distribution Law and its applications.

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Solutions of Non-electrolyte – Solution of Liquid and its Applications – Raoult's Law and Henry's law – Deviations from Raoult's Law – Gibbs – Duhem Margules Equation. Vapor Pressure of Non-ideal Gases. Fractional Distillation - Distillation of immiscible liquids – Steam distillation, Partially Miscible Liquids.

Derivation of Phase rule – phase equilibria in one component system – the phase diagram of water and sulphur systems – Two component system – reduced phase rule- simple eutectic system formed by Pb-Ag and Mg-Zn.

TEXT BOOKS / REFERENCES

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
2. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).
3. Gurdeep Raj, Advanced Physical Chemistry, Krishna Prakash, 3rd Ed. (2006).
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5. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand, New Delhi, (2008).
6. P.L. Soni, O.P. Dharmarha, Text Book of Physical Chemistry, Sultan Chand & Sons, New Delhi, 5th Edn., (1972).
7. R.T. Morrison, R.N. Boyd, Organic Chemistry Prentice Hall of India (P) Ltd., New Delhi, 2nd Edition (1974).
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15. J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).
16. P.B. Janarthanan, B. Sivakumar, Textbook of Inorganic Chemistry., Mohan Brimlani, Oxford & IBH Publishing Co., New Delhi, Copyright (1978).
17. R.D. Madan, Inorganic Chemistry, S. Chand, 3rd ed. (2014).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Skill Based Elective-II: PHARMACEUTICAL CHEMISTRY	IV	03	18BCH47S

UNIT - I

Definition of the terms -drugs, pharmacophore, pharmacodynamics, pharmacopoea, pharmacology, bacteria, virus, fungus, actinomycetes, metabolites, LD50, ED50.

Therapeutic index – its use in selection of drugs.-Mode of action of drugs- Assay of drugs – Biological and chemical methods.

UNIT - II

Sulphonamides : mechanism and action of sulpha drugs, preparation and uses of sulphathiazole and sulphapyridine.

Antibiotics: Definition, classification as broad and narrow spectrum antibiotics – penicillin, chloramphenicol, ampicillin – structure only.

UNIT-III

Analgesics : Definition and actions-narcotic and non narcotic-morphine and pethidine – pharmacological action- uses.

Antipyretic analgesics- salicylic acid derivatives- methyl salicylate, aspirin, p-amino phenol, paracetamol and ibuprofen-preparation and uses.

UNIT-IV

Antiseptics and disinfectants: Definition and distinction, phenol co-efficient, properties and uses of phenols and phenolic compounds- Dyes - crystal violet - acridine - cationic surfactants- Benzalkonium chloride and formaldehyde

Anaesthetics: Definition, classification- local and general- volatile- nitrous oxide, ether, chloroform, cyclopropane- uses and disadvantages- non volatile- intravenous- thiopental sodium and methanexitone.

UNIT-V

Drugs affecting CNS –definition, examples for tranquilizers, sedatives, hypnotics, psychedelic drugs- chlorpromazine. Hypoglycemic agents - sulphonyl urea, biguanides (only structure).

Chemotherapy-definition- cyclophosphamide, use of phytochemicals in cancer therapy- Taxol

Indian medicinal plants: Medicinal properties and uses of Hibiscus rosasinesis, Ocimum sanctum, Mangifera indica, Azadirachtra indica, Andrographis paniculata, Solatum trolbafum.

TEXT BOOKS / REFERENCES

1. Thiagarajan, Pharmaceutical Chemistry, Educational Publishers
2. G.R. Chatwal, Synthetic Drugs, Himalaya Publishing House, Bombay, 2nd Edn., (1988).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Paper –V:THEORETICAL CHEMISTRY	V	05	18BCH51C

Unit – I

Fundamentals of Quantum Chemistry: Failure of classical theory in explaining black body radiation – Planck's radiation formula – Quantization of Energy – Einstein's Theory of Photoelectric effect – de Broglie's Theory of wave – particle dualism – Heisenberg's Uncertainty Principle (problems) – Importance of wave mechanics – Application of Schrodinger wave equation to particle in one dimensional box–Significance of ψ and ψ^2 . Quantum numbers – Concept of atomic orbitals.

Unit – II

The Chemical Bonding: Ionic bonding –general properties of Ionic crystals - high melting, hardness, conductivity in molten state or in solution, solubility in polar solvent – Rock salt, CsCl – Crystal lattice energy and its determination by Born Haber cycle – factors affecting crystal lattice energy — ion polarization and Fajans rules.

Covalent bonding: Valence bond theory – directional character of hybrid orbitals – hybridization involving d- orbitals – complex ions – valance shell electron pair repulsion theory (VSEPR) and shapes of simple covalent molecules – resonance in molecules – molecular orbital theory as applied to σ and π bonds – partial ionic character of covalent bonds from electro negativity and dipole moment data –Hydrogen bonding – nature, energy and effects on structure and properties.

UNIT- III

Molecular Spectroscopy: Definition, quantization of energy, interaction of electromagnetic radiation with matter and changes induced , Absorption and emission spectroscopy.

Electronic Spectroscopy: Principle of electronic–spectroscopy,Types of electronic transitions , Born-Oppenheimer approximation, Franck-Condon principle, predissociation.

Microwave or Rotational Spectroscopy: Theory of rotational spectroscopy (rigid diatomic molecule), determination of bond length and the effect of isotopic substitution (Stark effect).

UNIT- IV

IR Spectroscopy: Principle of IR spectroscopy- molecular vibrations , vibrational frequency, fundamental vibrations for linear and non-linear molecules, selection rules. Combination bands, overtone and Fermi resonance. Factors affecting vibrational frequencies- inductive and mesomeric effects (with simple examples). Differentiating inter & intra molecular hydrogen bonding using IR spectra.

Group Theory: Symmetry elements and symmetry operations, simple point groups – C_{2v} and C_{3v} .

Unit – V

Electrical and Magnetic Properties of Molecules: Electrical properties – polar and non polar molecules – meaning of the terms – total molar polarization, orientation polarization and distortion polarization – determination of dipole moments of polar gases, liquids and solids – applications of dipole moments in the study of simple molecules.

Magnetic Properties of Molecules: Meaning of the Terms – Magnetic Susceptibility Magnetic moment – Dia-magnetism, Para-magnetism and Ferromagnetism – Determination of the

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Magnetic Susceptibility of paramagnetic substances using Guoy Balance – Applications of Magnetic properties in solving structural problems involving Simple and Complex ions.

TEXT BOOKS / REFERENCES

1. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw-Hill, New Delhi.
2. A.K. Chandra, Introductory Quantum Chemistry, WSE, 4th ed. (2010).
3. R.K.Prasad, Quantum Chemistry, New Age, 4th ed. (2011).
4. Chatwall and Anand, Quantum Mechanics, S. Chand, (2010).
5. P.W. Atkins, Molecular Quantum Mechanics (1988).
6. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
7. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).
8. Gurdeep Raj, Advanced Physical Chemistry, Krishna Prakash, 3rd Ed. (2006).
9. Satyaprakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry, S. Chand & Co., Ltd., New Delhi, 16th Revised Edn., (1985).
10. B.R. Puri, L.R. Sharma, Inorganic Chemistry, Miestone revised edition (2011).
11. J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).
12. P.B. Janarthanan, B. Sivakumar, Textbook of Inorganic Chemistry., Mohan Brimlani, Oxford & IBH Publishing Co., New Delhi, Copyright (1978).
13. K.V. Raman, Group Theory.
14. F.A. Cotton, Chemical Applications of Group Theory.
15. Y.R.Sharma,Elementary Organic Spect roscopy ,Principles and chemical applications, S. Chand & Co.,Ltd (2008)

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Paper – VI: ORGANIC CHEMISTRY – I	V	05	18BCH52C

Unit – I

Hydroxy Acids: – Preparation and uses of Lactic acid, Tartaric acid and Citric acid –ortho-, meta- and para- Hydroxy benzoic acids - their Preparation, Properties and Uses.

Phenols: Preparation, properties and uses of the following Phenols:

1. Monohydric Phenols: Phenols, Cresols, Xylenols and Naphthols
2. Dihydric Phenols: Catechol, Resorcinol and Quinol.
3. Trihydric Phenols: Phloroglucinol, Pyrogallol and Hydroxyquinol.

Unit – II

Acid Amides and Imides: -Preparation properties and uses of Acetamide, Urea, N-bromo succinimide, Benzamide, Phthalimide, Sulphanilamide and Saccharin.

Nitro Compounds: Preparation, Properties and Synthetic uses of Nitro methane, Nitro ethane, Nitrobenzene and meta Dinitrobenzene, Reduction of Nitrobenzene in neutral, acidic alkaline media and electrolytic reduction.

Unit – III

Amines: Classification and Separation of Primary, Secondary and Tertiary amines – Quaternary ammonium salts.

Preparation, Properties and Synthetic uses of Aliphatic amines, aniline, *N*-methylaniline, *N,N*-dimethylaniline – Phenylenediamines and Naphthyl amines – Basicity of amines. Diazotisation and coupling.

Unit – IV

Molecular Rearrangements: Pinacol – Pinacolone, Beckmann, Claisen Cope, Hoffmann, Curtius, Lossen, Schmidt and Benzil – Benzilic acid Rearrangements.

Isomerism: Stereo isomerism – Geometrical isomerism (C=C), (C=O) and (C=N) compounds. E-Z – Nomenclature. Optical isomerism–sequence rules and R,S notations. chirality, Asymmetric synthesis, Racemic mixture and Resolution of Racemic mixture. Optical Activity in Biphenyls, Allenes and Spiranes.

Unit – V

Heterocyclic Compounds: Preparation, Properties, Structure and Uses of Pyrrole, Furan, Thiophene, Pyridine, Quinoline, Isoquinoline, Indole, Indigo and Isatin.

TEXT BOOKS / REFERENCES

01. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand, New Delhi, (2008).
02. R.T. Morrison, R.N. Boyd, Organic Chemistry Prentice Hall of India (P) Ltd., New Delhi, 2nd Edition (1974).
03. J. March, Advance Organic Chemistry, John Wiley & Sons, Asia, New Delhi, 4th Edn., (2008).

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04. T. W. Graham Solomons, Organic Chemistry, Wiley, 4th ed. (2010).
05. P.L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, (2011).
06. O.D. Tyagi, M. Yadav, A Text Book of Reaction Mechanism, Anmol Publication Ltd., New Delhi, 1st Edn., (2002).
07. O.P. Agarwal, Organic Chemistry, S. Chand, 3rd ed. (2010).
08. Jagdamba Singh and Yadav, Organic Chemistry, Pragadeep, (2005).
09. I.L. Finar, Organic Chemistry, Volume 1, Longman Scientific & Technical (2000)

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Paper – VII: PHYSICAL CHEMISTRY – I	V	05	18BCH 53C

Unit – I

Electrical Transport and Ohm's Law: Conduction in metals and in electrolytic solutions – measurement of conductivity in electrolytic solution – migration of ions and Kohlrausch's law of independent migration of ions – Arrhenius theory of electrolytic dissociation and Ostwald's dilution law – the idea of strong and weak electrolytes – An elementary treatment of the Debye – Huckel – Onsager equation for strong electrolytes. Wein effect and Debye-Falkenhagen effect.

Transference number – principle – determination of transference number by Hittorff's method and moving boundary method.

Unit – II

Application of Conductivity Measurements: Determination of equivalent conductance of a weak organic acid – determination of solubility product of a sparingly soluble salt – ionic product of water, conductometric titrations.

Electrodes – the standard hydrogen electrode (SHE) – kinds of electrodes: gas / ion, metal / metal ion, metal / insoluble salt, redox electrodes – derivation of Nernst equation.

Unit – III

Electrochemical Cell – Conventional representation – Electromotive forces (EMF) – computation of the cell EMF – determination of E^0 of half cell – Temperature dependence of the cell EMF – thermodynamic quantities of cell reactions.

Reference electrodes – electrodes for the measurement of pH – Hydrogen, quinhydrone, glass electrode – concentration cells with and without transference – liquid junction potential – determination and elimination.

Unit – IV

Potentiometric Titrations: Acid / base, precipitation, redox titrations – buffer solutions – pH of a buffer. Henderson – Hasselbach equation – Evaluation of the dissociation constant of weak – decomposition potential – hydrogen over voltage – application .

Polarography: Representation of a Polarogram, Polarization, Polarographic cell assembly, Half – wave potential, Applications of polarography, Amperometric titrations.

Unit V

Electrochemical cells- Classifications - Storage batteries –Lead storage battery, Nickel-Cadmium cell and lithium ion cell.

Fuel cells –Hydrogen-oxygen and Hydrocarbon- oxygen.

Corrosion and passivity-electrochemical principle of rusting of iron. Prevention of corrosion.

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TEXT BOOKS / REFERENCES

1. Samuel Glasstone, An Introduction to Electrochemistry, EWP, (2008).
2. M.S. Yadav, Electrochemistry, Anmol, 3rd ed., (2006).
3. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
4. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).
5. Gurdeep Raj, Advanced Physical Chemistry, Krishna Prakash, 3rd Ed. (2006).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Skill Based Elective-III: TEXTILE CHEMISTRY	V	04	18BCH54S

Unit – I

Fundamentals of Textile Chemistry: General definition of a textile fibre and a textile filament – yarn count – classification of fibres – natural regenerated and synthetic – basic structural formula of cotton, silk, wool, rayon, acetates, nylon, polyester, PAN, PET non-acrylic fibres .

Fibre properties – crystallinity, tensile strength, tear strength, abrasion resistance, lusture and thermal properties.

Unit - II

Textile Processing: General sequence of processing by melt, dry and wet spinning of Textile Fibers. Textile chemical processing; (i) Sizing-desizing (ii) Singeing (iii) Scouring (iv) Bleaching (v) Mercerization (Principles, acid and alkali treatment and Conditions of operations)

Unit-III

Color and Constitution: Dye molecule – Chromophores – Auxochromes – Classification of Dyes – Principles of Textile Materials dyeing; Operation conditions, machinery and modern developments of acidic basic dyes, azoic dyes disperse dyes, direct dyes, sulfur dyes, mordant and vat dyes.

Different fastness properties to washing, rubbing, light, perspiration and sublimation.

Unit-IV

Principles of Textile Printing: Conditions, machinery and modern developments involved in styles of printing, pigment printing, block printing, screen printing, roller printing and rotary printing methods. Textile finishes: mechanical and functional finishes and their importance –resin finishes soft, stiff, water repellent, soil repellent and flame retardants.

Unit-V

Textile Treatment Processing: Physical and Chemical properties of water for textile processing, Requirement and estimation of the quality of water for textile processing-water softening – by chemical additions, ion exchange resins, demineralization. Importance of steam in textile dyeing processes – various types of boilers used in textile industries-nature of textile dye house effluents and their treatments.

Government Specifications and Pollution Control on Textile Industries.

TEXT BOOKS / REFERENCES

1. Gohl, Textile Science an Explanation of Fibre Properties, CBS, 3rd ed. (2009).
2. S.P. Mishra, Text Book of Fibre Science and Technology, New Age, 4th ed. (2010).

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Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	Paper – VIII: INORGANIC CHEMISTRY	VI	05	18BCH61C

Unit – I

Coordination Chemistry: Nomenclature – Isomerism in complexes – different types of structural isomerism – stereo isomerism – geometrical isomerism – optical isomerism – Theories of metal ligand bond: Werner's theory, EAN rule, Valence bond theory - postulates and applications, Crystal field theory – Postulates – Explanation with examples – Crystal Field Stabilization Energy – Crystal Field Splitting in Tetrahedral and Octahedral Complexes – Limitations – Comparison of the two theories (VB & CFT).

Unit – II

Lanthanides and Actinides: Isolation of Lanthanides – Position in the Periodic Table - oxidation states - Lanthanide Contraction - comparison of Lanthanides and Actinides. – Chemistry of Thorium and Uranium, occurrence, extraction, properties and uses.

Unit – III

Non – aqueous Solvents: Classification of solvents - general properties of ionizing solvents - Chemical reactions in liq NH₃ and liq SO₂.

Binary metallic compounds - Carbides and Nitrides - Classification, Preparation, Properties, Structure and Uses. Metallic carbonyls – mono and binuclear carbonyls of Ni, Fe, Cr, and Co and Mn- Synthesis, reaction and structure – Silicones and silicates – preparation and uses and structure.

Unit – IV

Metallic State: Close packing of atoms in metals (HCP and CCP) metallic bonding - Free electron theory - Valence bond approach - bond theory.

Structure of alloys – Intermetallic compounds - Substitutional – Interstitial solid solution. Hume Rothery ratios.

Semi-conductors – Types of semi conductors – Intrinsic semi conductors - extrinsic semi conductors – 'n' type and 'p' type semi conductors, theory properties and uses - Super conductors – basic concepts and applications..

Unit – V

Nuclear Chemistry: Isotopes - isobars – Aston's mass Spectrograph - nuclear stability – n/p ratio – Magic number - mass defect, packing fraction – nuclear binding energies – Radioactive series – Artificial radio activity – Synthesis of Artificial radio isotopes and New elements.

Nuclear Reactions: Nuclear Fission and Fusion Reactions – Fast and Breeder Type Reactors – Atomic Power Project in India – Application of Radio Isotopes – Carbon Dating (¹⁴C Dating), Biomedical, Agricultural and Industrial Applications. Spallation, Q-value.

TEXT BOOKS / REFERENCES

- Satyaprakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry, S. Chand & Co., Ltd., New Delhi, 16th Revised Edn., (1985).
 - B.R. Puri, L.R. Sharma, Inorganic Chemistry, Miestone revised edition (2011).
 - J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).
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6. P.B. Janarthanan, B. Sivakumar, Textbook of Inorganic Chemistry., Mohan Brimlani, Oxford & IBH Publishing Co., New Delhi, Copyright (1978).
7. R.D. Madan, Inorganic Chemistry, S. Chand, 3rd ed. (2014).
8. J. Huheey, Advanced Inorganic Chemistry, Pearson, 4th ed. (2011).
9. R.K. Dove, Nuclear Chemistry, Campus Books International, New Delhi, Revised 1st Edn., (2000).
10. Suresh Carg, Physics of Nuclear Reactions, Tat Mcraw Hill, 4th ed. (2011).

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Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	Paper –IX: ORGANIC CHEMISTRY – II	VI	05	18BCH62C

Unit – I

Alkaloids: Introduction, Classification and Isolation of Alkaloids – General methods of elucidation of Structure – Structural elucidation and synthesis of Conine, Piperine, Nicotine, Atropine and Papaverine..

Unit – II

Terpenoids: Introduction – Isoprene and Special Isoprene rule – Isolation and General properties – Classification – Structural elucidation of Geraniol, Menthol, α -Terpeniol, Limonene (Dipentene) and α -Pinene

Unit – III

Vitamins: Sources and structural elucidation of Vitamin A (Retinol), Vitamin B (Thiamine, Riboflavin), Vitamin C (Ascorbic acid). Deficiency diseases of vitamins A,B,C & D

Hormones – Structural elucidation of Thyroxin and Adrenaline.

Unit – IV

Carbohydrates: Classification, Mono-saccharides and Elementary account of Aldoses, Ketoses, D and L forms, Pentoses and Hexoses.

Hexoses: Structure of D(+) Glucose and D (-) Fructose – Open and Closed chain structures, muta rotation, Epimerization, Killiani-Fisher synthesis, Ruff's degradation. Conversion of Glucose to fructose and vice versa.

Disaccharides: Structural elucidation and Ring structure of Sucrose.

Polysaccharides: Elementary account of Starch and Cellulose.

Unit – V

Amino acids: classification and preparation of α -amino acids - Amination of α -halogenated acids - Gabriel phthalimide synthesis, Strecker synthesis, Erlenmeyer Aza lactone synthesis. Properties of amino acids - Zwitter ion, Iso-electric point, General Chemical Properties of amino acids.

Peptides: General method of synthesis of peptide –solid phase peptide synthesis.

Proteins: Classification, properties, structure (Primary, Secondary and tertiary) and identification tests.

TEXT BOOKS / REFERENCES

11. I.L. Finar, Organic Chemistry, Volume 2, Longman Scientific & Technical (2000).
12. T. Morrison, R.N. Boyd, Organic Chemistry Prentice Hall of India (P) Ltd., New Delhi, 2nd Edition (1974).
13. O.P. Agarwal, Chemistry of Natural Products, S. Chand, 3rd ed. (2009).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Paper – X: PHYSICAL CHEMISTRY– II	VI	05	18BCH63C

Unit – I

Programming in 'C': Superiority of 'C' over other languages – Basic structure of C programs, 'C'-character set-keywords and identifiers, constants, variables, data types- declaration of variables – Defining symbolic constants. Operators – Arithmetic operators, Logical operators, Assignment operators.-Arithmetic expressions – evaluation, Precedence of arithmetic operators. .

Applications in Chemistry: Few selected problems – Determination of molarity and normality of solutions, calculation of pH.

Unit – II Chemical Kinetics:

Order and molecularity -rate law expression , zero order and fractional order reactions. Derivation of integrated rate expression for first, second and zero order reactions. Factors influencing rate of the reaction. Characteristics of first ,second and zero order reactions.

Expressions for the half-life periods of zero, first, second, third and fractional order reactions. Determination of order of reaction – Half life period method, differential method, isolation method & graphical method. Experimental methods of measuring reaction rate- Polarimetry, Dilatometry, Colorimetric , Monometry and Volumetry.

Unit – III

Chemical Kinetics: Effect of Temperature on the Rate Constant - The Activation Energy - The Collision Theory of Reaction rates and its limitation - The Absolute Reaction Rates Theory (ARRT) - Comparison of Collision Theory with ARRT. Significance of Free Energy of Activation (ΔG^\ddagger) and Entropy of Activation – Lindemann's theory of Unimolecular reaction.

Unit – IV

Complex reaction – Consecutive, Parallel, Reversible Reactions and Chain Reactions, $H_2 - Cl_2$, and $H_2 - Br_2$ Reactions and their Kinetics – Fast reactions: – Flash photolysis – Flow Techniques – Relaxation Methods.

Unit – V

Photochemistry: Absorption of Light and Photophysical and Photochemical processes – Jablonski diagram – Fluorescence and Phosphorescence. The Stark – Einstein Law of Photochemical Equivalence, Laws of Light Absorption – Lambert's Law and Beer's law – Photochemical chain reaction – Hydrogen – Chlorine reaction, Hydrogen – Bromine reaction, Hydrogen – Iodine reaction – Quantum yield (ϕ) – Determination of quantum yield by Actinometry. Reasons for high and low Quantum yield. Comparison of Thermal and Photochemical Reactions of $H_2 - Cl_2$ and $H_2 - Br_2$. Photolysis of Acetaldehyde and Acetone. Photosensitized Reactions. Chemiluminescence.

TEXT BOOKS / REFERENCES

1. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
2. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).

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3. Gurdeep Raj, Advanced Physical Chemistry, Krishna Prakash, 3rd Ed. (2006).
4. Arun Bahl and B. S. Bahl, Introduction to Physical Chemistry, S. Chand, New Delhi, 3rd Ed. (1994).
5. P.L. Soni, O.P. Dharmarha, Text Book of Physical Chemistry, Sultan Chand & Sons, New Delhi, 5th Edn., (1972).
6. E. Balagurusamy, 'C' Programme, S. Chand, 3rd ed. (2011).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Skill Based Elective-IV: INDUSTRIAL CHEMISTRY	VI	04	18BCH67S

Unit – I

Sugar Industry: Manufacture of Crystalline sugar: Extraction of the Juice, Clarification of the Juice – Two step and One step process – Classification of Juice by Double carbonation process - Evaporation of Clarified juice to make syrup - Crystallization of Syrup – Use of Seed Crystals for Crystallization – Curing of Sugar – Double Centrifuging – Treatment of Molasses – Composition of Back strap – Refining of Raw sugar – Recovery of Bone char – Utilization of Bagasse – filter cakes used as manure – Testing and Estimation of Sugar – Industrial Spirit – Absolute Alcohol – Cane sugar industries in Tamilnadu and in India.

Unit – II

Pigments: Manufacture, Physical properties and Uses- White lead – French and Rowley process. ZnO – Electrolytic process. Blue Pigments: Cobalt blue and Ultra marine blue. Red pigment: Red Lead and Iron oxide.

Paints: Classification – Requirements of a Good Paint and Importance of pigment volume concentration (PVC) – Paints Failure. Emulsion Paints and Varnishes – constituents and Manufacture. Special paints.

Unit – III

Petroleum and Petroleum Products: Origin – Composition – Classification – Distillation – Natural Gasoline – Aviation Gasoline – Cracked Gasoline – Cracking Process – Thermal and Catalytic Process. Octane number – Flash point – Percentage and Principal products of Crude Petroleum – Antiknock Compounds . Petroleum Refineries in India.

Energy: Unit – sources – Renewable and Non-renewable – Conventional, Non-conventional – Solar Energy –Advantages.

Unit – IV

Cement Industry: Raw materials for Cement Manufacturing – Proportioning – Blending and Preparation of the raw mixture – The burning – Rotary kilns – Refractory material – Dry process – Wet process – Physical requirements of Cement – Varieties of cement – Tests and Specification (ISI Specification for Cement) – Setting of Cement – Cement Factories in Tamil Nadu and in India .

Unit – V

Iron and Steel Industry: – Iron- Carbon Alloy System – Phase Diagram of Fe-C and Its study – Function of Carbon in Steels and Its Classification – Heat Treatment of Steel – Annealing, Tempering, Normalizing, Hardening, Cold rolling of steel– Alloy Steels – Need for Alloying of Steels – Special Alloying Metals like Cr, Ni, Mn, V, and Co – Special Steels such as Magnetic Steels – Stainless steels, Tool steels and High speed steel.

TEXT BOOKS / REFERENCES

1. B.K. Sharma, Industrial Chemistry, Krishna Prakasam Medai (P) Ltd., Meerut, 4th Revised Edn., (2001).
2. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai & Sons, Delhi

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Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	Non-Major Elective-I: CHEMISTRY IN CHANGING LIFE-STYLE – I	V	03	18BCH5EL

Unit – I

Water Treatment: Introduction – Sources and Uses of Water – Water for Industrial Purposes – Quality of Normal water – water in human body – Hardness of water – Types - Softening of Water – Soda Lime Process, Zeolite, and Ion-exchange Processes (principles only). Demineralization of water – Treatment of Water for Municipal purposes – Desalination of Brackish Water – Electro dialysis – Reverse Osmosis Method (principles only).

Unit – II

Fermentation: Introduction – Conditions for Fermentation – Characteristics of Enzymes – Fermentation Processes – Alcohol Beverages – Wine, Beer- Manufacture of Spirits – Whisky – Wine. Vinegar – Manufacture. Manufacture of Power Alcohol – Alcohol from Molasses, Starch, Hydrocarbon gases – Uses.

Unit – III

Oils, Fats, Waxes and Soap: Waxes – Classification – Solubility – Saponification value – Manufacture of Candles – Hydrocarbon of Candles – Hydrogenation – of Oils – Soaps – Manufacture – detergents – Cleansing Action of Soaps.

Unit – IV

Food Adulteration and Hygiene: Definition of Adulteration Food – Common Adulterants in Different Foods – Toxic Effects of Some Metals and Chemicals – Contamination of Foods with Harmful Microorganisms – Detection of Adulteration in Some Common Food items – Food Additives and Preservatives – Food standards.

Unit – V

Paints: Classification – Requirements of a Good Paint and Importance of pigment volume concentration (PVC) – Paints Failure. Emulsion Paints , Enamels , Lacquers and Varnishes – constituents and Manufacture.

TEXT BOOKS / REFERENCES

3. B.K. Sharma, Environmental Chemistry, Krishna Prakasam Medai (P) Ltd., Meerut, 6th Revised Edn., (2001).
4. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai & Sons, Delhi
5. M. Swaminathan, Food & Nutrition, Bappco, 2nd ed. (2011).
6. B. Sri Lakshmi, Food Science, New Age, 5th ed. (2011).
7. Jayashree, Applied Chemistry, S. Chand, 3rd ed. (2013).

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Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Non-Major Elective-II: CHEMISTRY IN CHANGING LIFE-STYLE – II	VI	03	18BCH6EL

Unit – I

Chemistry in day-to-day life: Dry Cleaning of Clothes, Versatile Bleaching Agents. Environmental Pollution by Volatile Organic Solvents / Compounds (VOCs).

Lubricants; Definition, function of lubricants and properties. Examples, classification of lubrication, additives for lubricating oils, synthetic lubricants, greases and solid lubricants.

Unit – II

Milk and Milk Products: Milk, Changes at Room Temperature, Methods of Routine Examination of Milk. Classification of bacteria, acid products, peptonizing organisms, fat splitters, pathogens. Milk Products – Butter, Cheese, Fermented Milk, Curd, Yoghurt, Abnormal Changes in Milk and Milk Spoilage, Preservation of Milk and Milk Products.

Unit – III

Blood and Hametological agents: Composition of blood, blood grouping and matching, role of blood as oxygen carrier, blood pressure, coagulation of blood. Determination of blood urea (using urease method only).

Drugs: Cardiovascular drugs, action, dosage and examples of cardiac glycosides, antiarrhythmic drugs, antihypertension drugs and vasodilator.

Unit – IV

Special diets for specific diseases: Peptic ulcer, diabetes, mellitus, infective hepatitis, heart disease and hypertension.

Unit – V

Indian medicinal plants: Medicinal properties and uses of Hibiscus Rosasinesis, adathoda vasica, Ocimum sanctum, Mangifera Indica, Azadirachta Indica, Phyllanthum Niruri, Solanum Trolbafum.

TEXT BOOKS / REFERENCES

1. P.C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
2. V. Thiagarajan, Pharmaceutical Chemistry, Educational Publishers.
3. A.K. De. Environmental Chemistry.
4. B. Sri Lakshmi, Food Science, New Age, 5th ed. (2011).

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Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	Paper –I : ALLIED CHEMISTRY –I	III	05	18BPH/BBO/ BZO34A

Unit – I

Theories of Chemical Bonding: Ionic, and Covalent, Bonds, σ and π Bonding – H_2 Molecule, F_2 Molecule – Partial Ionic Character – Hydrogen Bonding – Types and Applications van Der Waals Forces.

Inter Halogen Compounds: ICl , BrF_3 , IF_5 – Preparation, Properties, Hybridization, and Structure.

Unit – II

Metallic Bonding: Free Electron Theory – Valance Bond Theory Band or Zone Theory – Semiconductors. Imperfections in crystal – Schottky defects, Frenkel defects and F-centeres.

Unit – III

Types of Organic Reactions and Reagents: Common Electrophiles, Nucleophiles and Free Radicals. Isomerism: Geometrical and Optical Isomerisms – Optical Isomerism in Lactic and Tartaric acids – Resolution. Geometrical Isomerism in Dichloroethyene, Maleic and Fumaric acid. Keto – Enol Tautomerism – Orbital overlap – Types of Hybridization and Geometry of Methane, Ethylene and Acetylene.

Unit – IV

Halogen Containing Compounds: Important Chloro hydrocarbons used as Solvents and Pesticides (Dichloro methane, Chloroform, CCl_4 , DDT, BHC) Chloro Fluro Carbons (CFCs) – Freons – Properties and Uses.

Aromatic Compounds: Aromatic electrophilic substitution in benzene – arenium ion mechanism - typical Substitution Reactions with mechanism – Nitration, Sulfonation, Halogenation, Friedel-Crafts Alkylation and Acylation, orientation in mono substituted benzenes. Synthesis and reactions of naphthalene.

Unit – V

Thermodynamics: Definition of Zeroth and First Law of Thermodynamics – Types of Systems – Reversible, Isothermal, Adiabatic, and Spontaneous Processes. Need for the Second Law – Carnot Cycle – Entropy and Its Significance.

TEXT BOOKS / REFERENCES

- V. Veeraiyan, Allied Chemistry – I, High Mount Publishing House (Educational Publishers), Chennai – 14.
 - B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
 - Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand, New Delhi, (2008).
 - R.T. Morrison, R.N. Boyd, Organic Chemistry Prentice Hall of India (P) Ltd., New Delhi, 2nd Edition (1974).
 - B.R. Puri, L.R. Sharma, Inorganic Chemistry, Miestone revised edition (2011).
 - J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).
- P.G. & Research Department of Chemistry, Government Arts College (Autonomous), Coimbatore – 641 018

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	Paper –II : ALLIED CHEMISTRY –II	IV	05	18BPH/BBO/ BZO44A

Unit – I

Co-ordination Chemistry: Introduction, Nomenclature, Werner, Sidgwick and Pauling's Theories– Chelation and Its Importance. Hemoglobin and Chlorophyll. Analytical applications in quantitative analysis - EDTA method of estimation of hardness of water.

Unit – II

Energy: Unit of Energy – Renewable and Non-renewable Sources of Energy. Conventional and Non-conventional Sources of Energy – Solar Energy – applications and advantages.

Fuel gases: Composition and uses of natural gas, water gas, semi water gas, producer gas and oil gas.

Unit – III

Heterocyclic Compounds: Preparation, Properties and Uses of Pyrrole, Furan, Thiophene, Pyridine.

Proteins: Classification, properties and biological functions -Primary and Secondary Structures of proteins.

Synthetic Polymers: Teflon, Alkyl Resins, Polyesters and Epoxy Resins – General Treatment.

Unit – IV

Chemical Kinetics: Order and Molecularity – Determination of Order, Activation Energy, Effect of Temperature on Reaction Rate – Catalysis – Types and Mechanisms, Industrial Applications.

Chromatography: Principles of Column, Paper and Thin Layer Chromatography.

Photochemistry: Laws of Photochemistry -Lambert's law, Beer-Lambert's law, Grotthuss-Draper law, Stark-Einstein's law. Quantum Yield – Fluorescence and Phosphorescence.

Unit – V

Electrochemistry: Specific Conductance, Equivalent Conductance, Effect of Dilution on Conductance, Ostwald's Dilution Law, Kohlrausch's Law – Applications.

Importance of P^H and Buffer Solution in Living Systems. Corrosion and its prevention.

Pollution: water, air, land and noise Pollution and their prevention.

TEXT BOOKS / REFERENCES

11. V. Veeraiyan Allied Chemistry – II, High Mount Publishing House (Educational Publishers), Chennai – 14.
12. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
13. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand, New Delhi, (2008).
14. R.T. Morrison, R.N. Boyd, Organic Chemistry Prentice Hall of India (P) Ltd., New Delhi, 2nd Edition (1974).
15. B.R. Puri, L.R. Sharma, Inorganic Chemistry, Miestone revised edition (2011).
16. J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).

PRACTICAL Distribution of marks

For B. Sc., Major Practicals

For each of the papers:

Total Marks =100 (Internal = 40 & External = 60)

Distribution of internal Marks:

Continuous assessment (for minimum of ten experiments) = 20

Test + Model examination = 15

Record = 05

Distribution of External Marks:

Total = 60 (Record:10 & Experiment(s): 50)

For Allied Chemistry practical:

Total Marks =50 (Internal = 20 & External = 30)

Distribution of internal Marks:

Continuous assessment (for minimum of ten experiments) = 10

Test + Model examination = 05

Record = 05

Distribution of External Marks:

Total = 30 (Record:05 & Experiment(s): 25)

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/ week	Sub Code
2018 – 19 onwards	CORE PRACTICAL – I: INORGANIC QUALITATIVE ANALYSIS	I & II	03	18BCH25P

Analysis of Inorganic Mixture Containing Two Acid and Two Basic Radicals. One of the acid radicals must be an interfering radical.

The Following may be Avoided:

1. Two Interfering radicals;
2. Combination of an Oxidizing and a Reducing agent;
3. Mixtures that Require Fusion.

The Following **anions and cations** may be given.

Carbonate	Phosphate	Iron	Strontium
Chloride	Oxalate	Chromium	Barium
Fluoride	Chromate	Cobalt	Magnesium
Bromide	Lead	Nickel	Ammonium
Sulfate	Copper	Manganese	
Nitrate	Bismuth	Zinc	
Borate	Cadmium	Calcium	

Distribution of Marks: Total = 60 (Record:10 & Experiment(s): 50)

Four radicals $4 \times 12.5 = 50$ marks

(For basic radicals, fixing the group alone = 3 marks, only spot tests = 3 marks)

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	CORE PRACTICAL – II: INORGANIC VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSIS	III & IV	03	18BCH46P

1. Volumetric Analysis

Acidimetry and Alkalimetry: Estimation of (1) Sodium carbonate, (2) Oxalic acid, (3) Carbonate – Bicarbonate Mixture.

Permanganometry: (4) Sodium oxalate, (5) Calcium, (6) Lead, (7) Ferrous ion, (8) Ferric ion Using Internal Indicator, (9) Percentage Purity of Pyrolucite.

Dichrometry : (10) Potassium dichromate, (11) Potassium permanganate

Iodometry – demonstration only.

2. Organic Qualitative Analysis

Organic substances with two functional groups may be given for analysis. The students have to report on the following;

- The Special Elements (N, S and Cl, Br, and I) Present or Absent.
- Whether Aliphatic or Aromatic.
- Whether Saturated or Unsaturated.
- The nature of the Functional Group Present (to be confirmed by a suitable reaction or by preparing a solid derivative).

Distribution of Marks: Total = 60 (Record: 10 & Experiment(s): 50)

Volumetric estimation = 25

Procedure = 5 marks; Experiment = 20 marks

Error <2% = 20 marks; 2-3%= 15 marks (less 1 mark for each 0.2 % error)

3-4%= 10 marks (less 1 mark for each 0.2% error); >4% 6 marks

Organic analysis = 25 marks

Special elements= 3x 2 = 6 marks

Aromatic/aliphatic = 4 marks (two tests)

Saturated or unsaturated = 4 marks (two tests)

Preliminary tests = 3 marks

Functional group = 6 marks

Solid derivative = 2 marks

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	CORE PRACTICAL – III: INORGANIC GRAVIMETRIC ESTIMATION AND PREPARATION	V & VI	03	18BCH64P

I. Gravimetric Estimations:

- i. Estimation of the percentages of water of hydration in crystalline barium chloride.
- ii. Estimation of barium as barium sulphate.
- iii. Estimation of barium as barium chromate.
- iv. Estimation of lead as lead chromate.
- v. Estimation of calcium as calcium oxalate monohydrate.
- vi. Estimation of nickel as Ni-DMG.

II. Inorganic complex preparation (minimum four preparations)

Distribution of Marks: Total = 60 (Record:10 & Experiment(s): 50)

Gravimetric estimation = 35

Procedure = 05 marks; Experiment = 30 marks

Error <2% = 30 marks; 2-3%= 25 marks (less 1 mark for each 0.2 % error)

3-4%= 15 marks (less 1 mark for each 0.1% error); >4% 10 marks

In-organic Preparation = 15 marks

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	CORE PRACTICAL – IV: PHYSICAL CHEMISTRY	V & VI	03	18BCH65P

Physical Chemistry Experiments

1. Distribution Coefficient

- Determination of distribution coefficient of iodine between water and carbon tetrachloride.
- Determination of the equilibrium constant for the reaction.
$$\text{KI} + \text{I}_2 \rightleftharpoons \text{KI}_3$$

2. Chemical Kinetics

- Determination of the hydrolysis constant of ethyl acetate with the given mineral acid.
- Determination of the rate constant of the reaction between I^- and $\text{S}_2\text{O}_8^{2-}$

3. Phase Rule

- Determination of the critical solution temperature of phenol - water system.
- Determination of the strength of sodium chloride solution.
- Phase diagrams of the following simple eutectic systems.
 - Naphthalene-diphenyl.
 - Naphthalene – p-nitrotoluene or p-nitrophenol.
 - Naphthalene – p-toluidine.

4. Determination of Molecular Weight (By Rast Method)

- Determination of the depression constant of the given solvent (naphthalene or diphenyl).
- Determination of molecular weight of the given substance.

5. Transition Temperature

- Determination of the transition temperature of the given salt hydrates.
 - $\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$.
 - $\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$.
 - $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$.
 - NaBr

6. Electrochemistry

- Determination of the cell constant of the given conductivity cell.
- Determination of the equivalent conductance of the given solution of a strong electrolyte.
- Determination of the degree of dissociation of acetic acid.
- Conductometric titration of a strong acid versus a strong base.
- Potentiometric Redox Titration ($\text{K}_2\text{Cr}_2\text{O}_7$ vs. Fe^{2+}).

7. Polarimetry: demonstration

- Determination of the strength of the given cane sugar solution.
Inversion of cane sugar in the presence of an acid.

Distribution of Marks: Total = 60 (Record:10 & Experiment(s): 50)

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	CORE PRACTICAL – V: APPLICATION ORIENTED PRACTICALS	V & VI	02	18BCH66P

I. Determination of Physical Constants.

1. Determination of Melting point
2. Determination of Boiling point.

II. Preparation of Organic dyes

1. Preparation of dyes like Methyl Orange, Methyl Red, Azo Amino benzene

III. Preparation of Organic Compounds

One stage preparations involving bromination, acetylation, benzylation, nitration, oxidation, and hydrolysis of organic compounds may be given. At least five preparations are to be given .

Examples:

- i) Preparation of Acetanilide from Aniline.
- ii) Preparation of p-Bromo acetanilide from Acetanilide.
- iii) Preparation of Phenyl benzoate from Phenol.
- iv) Preparation of Benzoic acid from Ethylbenzoate.
- v) Preparation of Salicylic acid from Methylsalicylate.
- vi) Preparation of Benzoic acid from Benzaldehyde.
- vii) Preparation of Benzoic acid from Benzamide.
- viii) Preparation of Glucosazone from Glucose.

IV. Preparation of Home care products

1. Preparation of white phenyl
2. Preparation of soap oil
3. Preparation of detergent powder
4. Preparation of transparent soap
5. Preparation of moisturizing cream

IV. Estimations

1. Estimation of Hardness of water using EDTA
2. Estimation of dissolved oxygen in water
3. Estimation of alkalinity in water
4. Estimation of calcium in limestone by EDTA method
5. Estimation of Total Fatty Matter (TFM) of a soap
6. Estimation of acid value of an oil
7. Estimation of available chlorine in bleaching powder

B. Sc., Chemistry

Distribution of Marks: Total = 60 (Record:10 & Experiment(s): 50)

Estimation = 25 marks

Error <10% = 25 marks; 10-15%= 20 marks (less 1 mark for each 1 % error)
15-20%= 15 marks (less 1 mark for each 1% error); >20% = 10 marks

Organic Preparation = 15 marks

Crude = 12 marks; Recrystallised sample = 03 marks

Determination of melting point/boiling point = 10 marks

REFERENCE BOOKS

1. Venkateswaran. V, Veeraswamy. R, Kulandaivelu. A.R., **Basic Principles of Practical Chemistry**, 2nd Edition, New Delhi, Sultan Chand and Sons, 1997.
2. Mendham. J., Denney. R.C., Barnes. J.D. and Thomas, M. **Vogel's Text Book of Quantitative Analysis**, 6th Edition, Pearson Education.
3. Sharma, K.K. and Sharma, D.S. **Introduction to Practical Chemistry**, Vikas Publishing House, New Delhi, 2005.
4. Praveen Kukreja, **Chemistry Advanced Practical Manual**, Vrinda Publishing (p) Ltd, New Delhi, 2006.

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	PROJECT with Viva – Voce	V & VI	-	18BCH68V

The Project Work may comprise of the following components:

1. Analysis of Waste Water, Industrial Effluent, and Sludge and other Solid, Liquid and / (or) Air Samples for Pollution Parameters as per TNPCB, CPCB, USEPA, and WHO Standards from various Industries such as Chemicals and Pharmaceutical, Cement, Sugar, Polymer, Dyeing and Textile, Food Industries, etc (the work which involves the application of Chemistry).
2. Latest / Current State of the Art Methodologies / Technologies.
3. Frequent Industrial Visit or On – Site Experimental Studies supported by proper Authorization Letter from the Concerned Industry.

Total Marks = 100 (Internal = 20 & External = 80)

Internal Marks, 20, to be awarded by the concerned Guide

Distribution of External Marks:

Viva-voce Examination = 20 & Project Report = 60

(Jointly by both Internal & External examiners)

B. Sc., Chemistry

Year	Subject Title	SEM	Hours/week	Sub Code
2018 – 19 onwards	ALLIED CHEMISTRY PRACTICAL (for PHYSICS/BOTANY/ZOOLOGY)	III & IV	03	18BPH/BBO/ BZO45P

1. Volumetric Analysis

Acidimetry – Alkalimetry: Estimation of sodium carbonate, bicarbonate, sodium hydroxide, Oxalic acid, etc.

Permanganimetry: Estimation of Ferrous ions and Oxalic acid.

Iodimetry: Estimation of Copper, Potassium dichromate.

2. Organic Qualitative Analysis

Detection of elements (N, S and Halogens) - To distinguish between aliphatic and aromatic, saturated and unsaturated compounds – functional group test for phenols, aromatic amines, aromatic acids, amides and carbohydrates.

Distribution of Marks: Total = 30 (Record:05 & Experiment(s): 25)

Volumetric estimation = 12

Error <2% = 12 marks; 2-3% = 9.5 marks (less 0.5 mark for each 0.2 %)

3-4% = 4.5 marks (less 0.5 mark for each 0.1%); >4% 4 marks

Organic analysis = 13 marks

Special elements = 3 x 1 = 3 marks

Aromatic/aliphatic = 2 marks (two tests)

Saturated or unsaturated = 2 marks (two tests)

Preliminary tests = 2 marks

Functional group = 4 marks