

GOVERNMENT ARTS COLLEGE
(Autonomous Institution & Accredited by NAAC with 'A' Grade)
P.G. & RESEARCH DEPARTMENT OF CHEMISTRY
COIMBATORE – 641 018, INDIA




BOARD OF STUDIES MEETING

ON

29.09.2014

SYLLABI FOR B.Sc., Degree Program in Chemistry
(Effect from 2015 - 16 Onwards)

		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 (Effect from 2015 - 16Onwards) CBCS										
		SYLLABI FOR B.Sc., Degree Program in Chemistry (Effect from 2015- 16 Onwards)										
							Marks					
Semester	S. No	Subject Code	Part	Subject	Hrs/week	Exam (Hrs)	External mark	Internal mark	Total	External Passing Minimum.	Total passing minimum	No. of Credits
I	1		I	Language I-Tamil -I	6	3	75	25	10	30	40	3

									0			
	2		II	Language II- English – I	6	3	75	25	1 0 0	30	40	3
	3		III	Core-I:General Chemistry– I	5	3	75	25	1 0 0	30	40	4
	4		III	Allied Mathematics – I	8	3	75	25	1 0 0	30	40	5
	5		III	Core Practical-I Inorganic Qualitative Analysis	3							
	6		IV	Environmental Studies	2	3	75	25	1 0 0	30	40	2
II	1		I	Language I - Tamil – II	6	3	75	25	1 0 0	30	40	3
	2		II	Language II - English – II	6	3	75	25	1 0 0	30	40	3
	3		III	Core-II: General Chemistry–II	5	3	75	25	1 0 0	30	40	4
	4		III	Mathematics – II	8	3	75	25	1 0 0	30	40	5
	5		III	Core Practical I - Inorganic Qualitative Analysis	3	3	60	40	1 0 0	24	40	5
	6		IV	Value Education	2	3	75	25	1 0 0	30	40	2
Total					60				1 1 0 0			3 9
III	1		I	Language I - Tamil – III	6	3	75	25	1 0 0	30	40	3
	2		II	Language II - English – III	6	3	75	25	1 0 0	30	40	3
	3		III	Core-III:General Chemistry – III	4	3	75	25	1 0 0	30	40	4

	4		III	Allied Physics – I	5	3	60	15	7 5	24	30	3
	5		III	Allied Physics Practical	3	-	--	--	--	--	--	--
	6		III	Core Practical-II: Volumetric and Organic Qualitative Analysis	3	--						
	7		IV	Skill Based ElectiveI Polymer Chemistry	3	3	75	25	1 0 0	30	40	3
IV	I		I	Language I - Tamil – IV	6	3	75	25	1 0 0	30	40	3
	2		II	Language II - English – IV	6	3	75	25	1 0 0	30	40	3
	3		III	Core-IV: General Chemistry – IV	4	3	75	25	1 0 0	30	40	4
	4		III	Allied Physics – II	5	3	60	15	7 5	24	30	3
	5		III	Allied Physics Practical.	3	3	30	20	5 0	12	20	4
	6		III	Core Practical- II Volumetric and Organic Qualitative Analysis	3	6	60	40	1 0 0	24	40	5
	7		IV	Skill Based Elective - II Pharmaceutical Chemistry	3	3	75	25	1 0 0	30	40	3
	8		V	Extension activities NCC/NSS/YRC/PE d								
Total					60				1 1 0 0			4 2
V	1		III	Theoretical Chemistry	5	3	75	25	1 0 0	30	40	4
	2		III	Organic Chemistry – I	5	3	75	25	1 0 0	30	40	4
	3		III	Physical Chemistry – I	5	3	75	25	1 0 0	30	40	4
	4		IV	SkillBasedElectiveI II:Textile Chemistry	4	3	75	25	1 0	30	40	3

									0			
	5		IV	Non major Elective-I: Chemistry in Changing Life Style – I	3	3	75	25	100	30	40	2
	6		III	Gravimetric Analysis and Organic Preparations	3	--						
	7		III	Physical Chemistry Practicals	3	--						
	8		III	Project	2	--						
VI	1		III	Inorganic Chemistry	5	3	75	25	100	30	40	4
	2		III	Organic Chemistry – II	5	3	75	25	100	30	40	4
	3		III	Physical Chemistry – II	5	3	75	25	100	30	40	4
	4		IV	SkillBased Elective-IV Industrial Chemistry	4	3	75	25	100	30	40	3
	5		IV	Non major Elective II: Chemistry in Changing Life Style – II	3	3	75	25	100	30	40	2
	6		III	Gravimetric Analysis and Organic Preparations	3	3	60	40	100	24	40	5
	7		III	Physical Chemistry Practicals	3	3	60	40	100	24	40	5
	8		III	Project with Viva Voce.	2	80 (Report)		20 (Viva)	100	40	40	15
Total					60				1300			59

Subject	Part	Total Credits	Total Marks
Language I: Tamil	I	12	400
Language II: English	II	12	400

Core	III	40	1000
Allied	III	20	400
Core Practical	III	20	400
Project	III	15	100
Skill Based Elective	IV	12	400
Non-Major Elective	IV	4	200
Environmental Studies	IV	2	200
Value Education		2	
Extension Activities	V	1	---
Total		140	3500



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SEMESTER – I

PAPER – I: BCH 13 C: GENERAL CHEMISTRY – I 75 Hrs.
(INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)

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: ICl₃, 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

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

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.

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. Fifield, D. Kealy, Principles and Practice of Analytical Chemistry, Chapman & Hall Publishers, New York, 5th Edn., (2000).

SEMESTER – II

PAPER – II: BCH 23 C: GENERAL CHEMISTRY – II 75 Hrs. (INORGANIC, ORGANIC & PHYSICAL CHEMISTRY)

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, 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.

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. Standard Entropies. 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).
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).
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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. Fifield, D. Kealy, Principles and Practice of Analytical Chemistry, Chapman & Hall Publishers, New York, 5th Edn., (2000).

SEMESTER – III

PAPER – III: BCH 33 C: GENERAL CHEMISTRY – III 60 Hrs. (INORGANIC, ORGANIC and PHYSICAL CHEMISTRY)

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, Claisen, Dieckmann, Benzoin, Condensations. Knoevenagel, Cannizzaro, Reformatsky and Haloform Reactions.

Reduction Reactions: Wolff-Kishner, MPV- Applications of reducing reagents like LiAlH₄, NaBH₄.

Unit-IV

Nucleophilic Substitution Reactions: Mechanisms of SN₁, SN₂, SN_i 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 Energies 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 (μ): Gibb's Duhem Equation and its Application - Chemical Potential for Ideal gases. Variation of μ with T and P. Clapeyron Equation, Clausius – Clapeyron Equation: Derivations and their Applications. Basic ideas regarding activity, fugacity and activity coefficient.

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 Equilibrium. Vont Hoff Isotherm and Isochore.

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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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).

SEMESTER III

SBE 1

POLYMER CHEMISTRY (ELECTIVE PAPER)

45 Hrs

Unit I

Polymers: 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

Living polymers, coordination polymerization – Ziegler-Natta catalysts –importance, examples- monometallic and bimetallic mechanism

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

Unit III

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

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

Unit IV

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 V

Processing of Polymers: Additives for polymers: Fillers, colourants, plasticisers, antioxidants and flame retarders. Film and sheet formation, blow molding, compression molding, transfer molding, extrusion molding and injection molding. Polymer Nanocomposites – Polymers for Photoresist Applications in Nanotechnology.

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).
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).

SEMESTER – IV

**PAPER – IV: BCH 43 C: GENERAL CHEMISTRY – IV
(INORGANIC, ORGANIC and PHYSICAL CHEMISTRY)**

60 Hrs.

Unit – I

The Structural distinction between solids and liquids. The nature of Cohesive forces in liquids and solids.

Amorphous and Crystalline Solids – Differences – Isotropy – Anisotropy. The Symmetry in Crystals. The Crystal classes – Crystal Planes and Faces – Laws of Rational indices – Miller indices, Bragg's Equation – Radius ratio rule. Imperfections in Crystals – Point defects – Stoichiometric and Non-stoichiometric 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, monal metal

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

Platinum – Extraction andUses. 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, succinic acid.

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

Unit – IV

Colligative properties of Dilute Solutions: Osmosis and Osmotic Pressure. Theories of semipermeability – Reverse Osmosis – The Elevation of Boiling Point and The Depression of 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 – Association, Dissociation and Combination of the Solute with the solvent. Applications of Nernst Distribution Law.

Unit – V

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.

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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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4. Samuel Glasstone, Thermodynamics for Chemists, East West press, (2008).
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6. P.L. Soni, O.P. Dharmarha, Text Book of Physical Chemistry, Sultan Chand & Sons, New Delhi, 5th Edn., (1972).
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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).
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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).

SEMESTER IV

SBE 2 PHARMACEUTICAL CHEMISTRY (Elective Paper)

45 hours

UNIT -I

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

Therapeutic index – their use in selecting 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 (No preparation , assay etc.)

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(only structure).

UNIT-IV

Antiseptics and disinfectants; Definition and distinction, 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 methohexitone.

UNIT-V

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

Chemo therapy-definition- cyclophosphamide, use of phytochemicals in cancer therapy- Taxol.

TEXT BOOKS / REFERENCES

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

SEMESTER – V

PAPER – V: BCH 51 C: THEORETICAL CHEMISTRY 75 Hrs.

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 – particle in one dimensional box – elementary treatment of Schrodinger wave equation, Quantum numbers – Concept of Orbitals. Significance of ψ and ψ^2 .

Unit – II

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

Covalent bonding: Valence bond theory – directional character of hybrid orbitals – hybridization involving d- orbitals – complex ions – valence shell electron pair repulsion theory (VSEPR) 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 – Coordinate bonds with examples.

UNIT- III

Molecular Spectroscopy: Definition, quantization of energy, regions of the spectrum and the changes induced. Absorption and emission spectra.

Electronic Spectroscopy: Types of electronic excitations, Born-Oppenheimer approximation, Franck-Condon principle, predissociation.

Microwave and Rotational Spectroscopy: Rotation of molecules, Theory of rotation spectra (rigid diatomic molecule), determination of bond length and the effect of isotopic substitution. (Stark effect)

UNIT- IV

IR Spectroscopy: Theory of vibration spectra- vibrating diatomic molecule-energy of diatomic molecule, simple harmonic oscillator, anharmonic oscillator and diatomic vibrating-rotator. Vibrations of polyatomic molecules and types (eg. H₂O & CO₂).

Group Theory: Symmetry elements and symmetry operation, 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 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.

SEMESTER – V

PAPER – VI: BCH 52 C: ORGANIC CHEMISTRY – I

75 Hrs.

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: 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 and electrolytic media.

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 – Phenylene diamines and Naphthyl amines – Basicity of amines. Mechanism of diazocoupling.

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

15. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand, New Delhi, (2008).
16. R.T. Morrison, R.N. Boyd, Organic Chemistry Prentice Hall of India (P) Ltd., New Delhi, 2nd Edition (1974).
17. J. March, Advance Organic Chemistry, John Wiley & Sons, Asia, New Delhi, 4th Edn., (2008).
18. T. W. Graham Solomons, Organic Chemistry, Wiley, 4th ed. (2010).
19. P.L. Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, (2011).

20. O.D. Tyagi, M. Yadav, A Text Book of Reaction Mechanism, Anmol Publication Ltd., New Delhi, 1st Edn., (2002).
21. O.P. Agarwal, Organic Chemistry, S. Chand, 3rd ed. (2010).
22. Jagdamba Singh and Yadav, Organic Chemistry, Pragadeep, (2005).
23. I.L. Finar, Organic Chemistry, Volume 1, Longman Scientific & Technical (2000)

SEMESTER – V

PAPER – VII: BCH 53 C: PHYSICAL CHEMISTRY – I

75 Hrs.

Unit – I

Programming in 'C': Introduction to computers and computer languages 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

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 the equivalent conductivity of strong electrolytes.

Electrical Conduction: Conduction at high fields and high frequencies – Transference number – principle – determination of transference number by Hittorff's method and moving boundary method.

Unit – III

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.

Electrochemical Cells: Electrode potential – the standard hydrogen electrode (SHE) – kinds of electrodes: gas / ion, metal / metal ion, metal / insoluble salt, redox electrodes – Nernst equation.

Unit – IV

Electrokinetic Phenomena: The 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.

Unit – V

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

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

TEXT BOOKS / REFERENCES

24. E. Balagurusamy, 'C' Programme, S. Chand, 3rd ed. (2011).
25. Samuel Glasstone, An Introduction to Electrochemistry, EWP, (2008).
26. M.S. Yadav, Electrochemistry, Anmol, 3rd ed., (2006).
27. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., New Delhi, 28th Edn., (2004).
28. G.W. Castellan, Physical Chemistry, Addison – Wesley Publication Co., London, II Printing, (1973).
29. Gurdeep Raj, Advanced Physical Chemistry, Krishna Prakash, 3rd Ed. (2006).

SEMESTER V

PAPER – VIII: SBE 3: TEXTILE CHEMISTRY

60 Hrs.

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 – degree of polymerization and its significance.

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, vat and other natural 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).

SEMESTER VI

PAPER – IX: BCH 61 C:

INORGANIC CHEMISTRY

75 Hrs.

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. Elements with atomic number 104 and 105. – Chemistry of Thorium and Uranium, 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 silicotes – preparation and uses and structure.

Unit – IV

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

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

3. Satyaprakash, G.D. Tuli, S.K. Basu, R.D. Madan, Advanced Inorganic Chemistry, S. Chand & Co., Ltd., New Delhi, 16th Revised Edn., (1985).
4. B.R. Puri, L.R. Sharma, Inorganic Chemistry, Miestone revised edition (2011).
5. J. D. Lee, Concise Inorganic Chemistry, Wiley, 5th ed., (2010).

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).

SEMESTER VI

PAPER – X: BCH 62 C: ORGANIC CHEMISTRY II

75 Hrs.

Unit – I

Alkaloids: Introduction, Classification and Isolation of Alkaloids – General methods of elucidation of Structure – Structural elucidation 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 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: Synthesis, Terminal group Analysis.

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).

SEMESTER VI

PAPER – XI: BCH 63 C: PHYSICAL CHEMISTRY – II

75 Hrs.

Unit – I

Chemical Kinetics: Empirical Laws and Experimental aspects – Order and Molecularity – Determination of the Rate Law – The Integrated Equation for I, II, III, Zero (0) and Fractional orders – Factors influencing the rate of the reaction.

Unit – II

Chemical Kinetics: Expression for the half-life periods of zero, first, second, third and fractional order reaction. Determination of Order of Reaction – Half life Period Method, Differential Method, Isolation Method, Graphical Method using Integrated Rate Equation Method. Experimental Techniques involved in following the kinetics of reaction. Polarimetry, Dilatometry, Colorimetric Method, 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 Photochemical process – 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) – High and Low Quantum yield.

Actinometry – Experimental Method to Determine Quantum Yield (ϕ) – Reasons for high and low ϕ , Photochemical chain reactions of $H_2 - Cl_2$, $H_2 - Br_2$ and $H_2 - I_2$. Comparison of Thermal and Photochemical Reactions of $H_2 - Cl_2$, and $H_2 - Br_2$. Photolysis of Acetaldehyde and Acetone – Photosensitized Reaction – Phosphorescence, Fluorescence and 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).
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).

SEMESTER VI

SBF4:

INDUSTRIAL CHEMISTRY

60 Hrs.

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 industry in India – Sugar Factories of Tamil Nadu.

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 Importance of 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 India – Cement Factories in Tamil Nadu.

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

SEMESTER V

NME1: CHEMISTRY IN CHANGING LIFE-STYLE – I 45 Hrs.

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 Importance of 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).

SEMESTER VI

NME2: CHEMISTRY IN CHANGING LIFE-STYLE – II 45 Hrs.

Unit – I

Chemistry in day today 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

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

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

Unit – IV

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

Unit – V

Indian medicinal plants: Medicinal properties and uses of Hibiscus Rosasinesis, adathoda vasica, Ocimum sanchum, Mangifera Indica, Azadirachtra Indica, Phyllantum Niruri, Solatum 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).

Unit – I

Theories of Chemical Bonding: Ionic, and Covalent, Bonds, σ and π Bonding – H₂ Molecule, F₂ Molecule – Partial Ionic Character – Hydrogen Bonding – Types and Applications van Der Waals Forces.

Inter Halogen Compounds: ICl, BrF₃, IF₅ – 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 Reaction and Reagents: Common Electrophiles, Nucleophiles and Free Radicals. Isomerism: Geometrical and Optical Isomerisms – Optical Isomerism in Lactic and Tartaric acids – Resolution. Geometrical Isomerism in Dichloroethylenes, Maleic and Fumaric acid. Keto – Enol Tautomerism – Orbital overlap – Hybridization and Geometry of Methane, Ethylene and Acetylene.

Unit – IV

Halogen Containing Compounds: Important Chloro hydrocarbons used as Solvents and Pesticides (Dichloro methane, Chloroform, CCl₄, 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. Preparation 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

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

Unit – I

Co-ordination Chemistry: Introduction, Nomenclature, Theories of – Werner, Sedgwick and Pauling's – 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: Pyrrole, Furan, Thiophene, Pyridine, Preparation, Properties and Uses.

Proteins: Classification and properties, biological function-Primary and Secondary Structure of protein.

Synthetic Polymers: Teflon, Alkyl Resins, Polyesters 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's.

Photochemistry: Laws of Photochemistry (Lambert's law, Beer-Lambert's law, Grotthus-Draper law, Stark-Einstein's law), Quantum Yield and its Applications – Fluorescence and Phosphorescence.

Unit – V

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

Importance of P^H and Buffer Solution in Living Systems. Corrosion and Its Prevention.

Pollution: water, air and land Pollution.

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)

Project:

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)

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 (MAJOR)

PRACTICAL SYLLABUS

I YEAR: SEMESTERS I and II

BCH 25 P: P1 PRACTICAL – I: INORGANIC QUALITATIVE ANALYSIS 90 Hrs

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)

II YEAR: SEMESTERS III and IV

BCH 46 P: P2 PRACTICAL – II: INORGANIC VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSES

90 Hrs.

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 and Iodometry: (10) Potassium dichromate, (11) Potassium permanganate

Argentimetry: (14) Chloride ion.

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% = 5 marks (less 1 mark for each 0.1% error); >4% 5 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 = 5 marks

Solid derivative = 3 marks

BCH 66 P: P3 PRACTICAL – III: INORGANIC GRAVIMETRIC ESTIMATION AND ORGANIC PREPARATIONS**90 Hrs.****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 Organic Preparation

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 Glucosazone from Glucose.

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

Gravimetric estimation = 35

Procedure = 5 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

Organic Preparation = 15 marks

Crude = 10 marks; Recrystallised sample = 05 marks

BCH 67 P: P4 PRACTICAL – IV: PHYSICAL CHEMISTRY 90 Hrs.

Physical Chemistry Experiments

1. Distribution Coefficient

- Determination of distribution coefficient of iodine between water and carbon tetra chloride.
- 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.
 - $\text{CH}_3\text{COONa} \cdot 3\text{H}_2\text{O}$.
 - $\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$.
 - $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$.

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:

- 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)

III YEAR:**SEMESTER VI****BCH 68 P****P4****PROJECT with Viva – Voce****60 Hrs**

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.

ALLIED CHEMISTRY (for Other Majors) PRACTICAL

PRACTICAL – IV:

90 Hrs.

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