KANCHI MAMUNIVAR CENTRE FOR POST-GRADUATE STUDIES (AUTONOMOUS), PUDUCHERRY

DEPARTMENT OF CHEMISTRY

M. Sc. & M.Phil.

CHEMISTRY SYLLABUS

UNDER CBCS SYSTEM

2018 – 2019 BATCH

STRUCTURE OF M.Sc. CHEMISTRY COURSE
OFFERED UNDER CBCS SYSTEM FOR 2018–2019 BATCH

Paper Code	Title of the Paper	Hours/ Week (30)				Int. Mark	Ext. Mark	Total Mark
		L	T	P	C			
FIRST SEMESTER								
CHHT–101	Concepts in Inorganic Chemistry	4	1	0	3	40	60	100
CHHT–102	Stereochemistry & Organic Reactions	4	1	0	3	40	60	100
CHHT–103	Thermodynamics & Kinetics	4	1	0	3	40	60	100
CHHT–104	Environmental Chemistry	4	1	0	3	40	60	100
CHHP–105	Practical–I Organic Chemistry	9	0	9	4	40	60	100
	SEMINAR/TEST/LIBRARY	1						
SECOND SEMESTER								
CHHT–201	Coordination & Organometallic Chemistry	3	1	0	3	40	60	100
CHHT–202	Organic Reaction Mechanisms	3	1	0	3	40	60	100
CHHT–203	Electrochemistry & Quantum Chemistry	3	1	0	3	40	60	100
CHHT–204	Polymer Chemistry	3	1	0	3	40	60	100
CHHP–205	Practical–II Inorganic Chemistry	9	0	9	4	40	60	100
	SEMINAR/TEST/LIBRARY	1						
	SOFT CORE (Offered by OTHER Departments)	3	1	0	3	40	60	100
THIRD SEMESTER								
CHHT–301	Bioinorganic & Inorganic Photochemistry	3	1	0	3	40	60	100
CHHT–302	Organic Spectroscopy	3	1	0	3	40	60	100
CHHT–303	Quantum Mechanics & Group Theory	3	1	0	3	40	60	100
CHHT–304	Pharmaceutical Chemistry	3	1	0	3	40	60	100
CHSC–305A (or) 305B	SOFT CORE (Main) Industrial Chemistry (or) Chemistry of Consumer Products	3	1	0	3	40	60	100
CHHP–306	Practical–III Physical Chemistry	9	0	9	4	40	60	100
	SEMINAR/TEST/LIBRARY	1						

FOURTH SEMESTER								
CHHT–401	Techniques in Inorganic Chemistry	3	1	0	3	40	60	100
CHHT–402	Organic Synthesis & Reactions	3	1	0	3	40	60	100
CHHT–403	Solid State & Photochemistry	3	1	0	3	40	60	100
CHSC–404A (or) 404B	**SOFT CORE (Main)** Green Chemistry (or) Forensic Chemistry	3	1	0	3	40	60	100
CHSC–405A (or) 405B	**SOFT CORE (Main)** Chemistry of Materials (or) Food Chemistry and Technology	3	1	0	3	40	60	100
CHHP–406	Practical–IV Instrumental Experiments	8	0	8	3	40	60	100
	SEMINAR/TEST/LIBRARY	1						
1. Basic Chemistry–I (for Botany and Zoology) 2. Basic Chemistry–II (for Physics) 3. Chemistry in Life (Common for students of any Branch).		**Total Credits 72**				**Total Marks 2300**		

For M.Sc. Degree

Total marks for each theory paper = 100 Marks (CIA = 40* marks (Test = 15 (Best two out of Three) + Model Exam = 15 + Seminar = 10) and End Semester Examination = 60 marks).

*For Paper CHSC–305A or 305B 10 marks allocated for the report of Industrial visit and the remaining 30 marks (Test = 10 (Best two out of Three) + Model Exam = 10 + Seminar = 10) for CIA.

Question Paper Pattern (Theory):

Part–A (2 × 5 = 10 marks) Answer **all** the questions
5 Two mark questions – at least 1 question from each unit.
Part–B (5 × 4 = 20 marks) Answer **all** the questions
4 Five mark questions each with internal choice (one question from each unit).
Part–C (10 × 3 = 30 marks) Answer any **three** questions
5 Ten mark questions – at least 1 question from each unit (maximum 2 subdivisions (5 + 5) in a question).

Total marks for each practical = 100 marks (CIA = 40 marks (Performance = 15 + Skill = 10 + Model Exam = 15) and End Semester Examination = 60 marks).

REVISED SYLLABUS (CBCS) FOR MASTER OF SCIENCE IN CHEMISTRY

1.	TITLE	: M.Sc. CHMISTRY
2.	YEAR OF IMPLIMENTATION	: Implemented from the Academic Year 2018-19 onwards.
3.	PREAMBLE	
	Total number of semesters	: 4 (Two semesters per year)
	Total number of papers	: 19
	Total number of practical courses	: 4
	Number of theory papers per semester	: I – 4; II – 5; III – 5; IV – 5
	Number of practicals per semester	: 1
	Maximum marks per paper (Theory)	: 100
	Maximum marks per paper (Practical)	: 100
	Distribution of Marks (Theory)	: Continuous Internal Assessment 40 + External Evaluation 60
	Distribution of Marks (Practical)	: Continuous Internal Assessment 40 + External Evaluation 60
4.	TOTAL MARKS FOR M.Sc. DEGREE	
	Theory paper	: 1900
	Laboratory course (Practicals)	: 400
	Total Marks	: 2300
5.	TOTAL CREDITS FOR M.Sc. DEGREE	: 72

KANCHI MAMUNIVAR CENTRE FOR POST–GRADUATE STUDIES
(AUTONOMOUS)
PUDUCHERRY–605 008

DEPARTMENT OF CHEMISTRY
CBCS–SYLLABUS

I–YEAR M. Sc. CHEMISTRY
I–SEMESTER

CHHT–101 CONCEPTS IN INORGANIC CHEMISTRY

UNIT– I COVALENT BONDING AND STRUCTURE OF MOLECULES 15 Hrs

Review of V.B Theory: Hybridisation and VSEPR–Structures of simple molecules. M.O. Theory: LCAO method–M.O. diagrams for homo and hetero nuclear diatomic and simple polyatomic molecules. Bond properties: bond order, bond length, bond energy–correlation. Carboranes and metallocarboranes–isopoly and heteropoly anions of vanadium, molybdenum and tungsten–metal clusters.

UNIT–II IONIC BONDING AND SOLID STATE 15 Hrs

Symmetry elements and symmetry operations: proper and improper rotation axes–screw axes and glide planes. Close packing of atomic spheres–crystal systems–unit cell–Bravais lattice. Structures of CsCl, sphalerite, wurtzite, fluorite and antiflourite, rutile, perovskite and spinels. Lattice energy–Born-Lande, Born-Mayer and Kapustinskii equations–Born-Haber cycle and energetics of dissolution of ionic compounds.

UNIT–III THEORY OF SOLIDS 15 Hrs

Metallic states–free electron and band theories–imperfections in solids–Frankel and Schottky defects, non–stoichiometric defects, line defects, plane defects–defect equilibria. Introduction to properties of metals–insulators and semiconductors–Hall effect–super conductivity and High T_C superconductivity. Inter metallic compounds, Solid solutions, Laves–zintle phases–Hume–Rothary rules.

UNIT–IV NUCLEAR CHEMISTRY 15 Hrs

Properties of nucleus–different types of nuclear forces–liquid drop and shell models of nucleus–spin and pairity–nuclear reactions induced by charged particles–nuclear reaction cross section–significance and determination. Theory of nuclear fission–conditions for controlled fission and chain reactions. Nuclear reactor and its components. Production of feed materials for nuclear reactors–disposal of radioactive waste–nuclear fusion and stellar energy.

References

1. J.E. Huheey, Inorganic Chemistry–Principle, Structure and Reactivity, 4th edition, Harper Collins College Publishers, New York, 1993.
2. B. Douglas, D. McDaniel and J.J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd edition, John Wiley & Sons, Blaisdell Publishing Co., 1995.
3. P.W. Atkins, D.K. Shriver and C.H. Langford, Inorganic Chemistry, 3rd edition, Oxford University Press, 1999.
4. L.V. Azaraff, Introduction to Solids, Tata McGraw Hills Publishing Co. Ltd., New Delhi, 1993.
5. A.F. Wells, Structural Inorganic Chemistry, 5th edition, Oxford University Press, New York, 1984.
6. H.J. Arnikar, Essentials of Nuclear chemistry, 2nd edition, New Age International, 1995.
7. S. Glasstone, Source Book of Atomic Energy, Affiliated East West Press, New Delhi, 1969.
8. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 1988.
9. G. Friedlander, J.W. Kennedy and N.M. Miller, Nuclear and Radiochemistry, John Wiley, 1981.
10. L. Pauling, The Nature of Chemical Bond, Cornell University Press, 1961.

CHHT–102 STEREOCHEMISTRY & ORGANIC REACTIONS

UNIT–1 STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS 15 Hrs

Configuration : Fischer projection–Sawhorse and Newman projections–R & S notations, simple and axially chiral molecules, methods of determining configurations, asymmetric synthesis–enantioselective and diastereoselective, Cram's rule and Prelog's rule.

Geometrical isomerism of monocyclic and fused ring compounds. Enantiotopic and diastereotopic atoms, groups and phases, stereospecific and stereoselective reactions. Conformation and reactivity of cyclohexane, substituted cyclohexanes and decalins.

UNIT–II SUBSTITUTION REACTIONS 15 Hrs

Aliphatic substitution reactions: Neighbouring group mechanism–anchimeric assistance–classical and non–classical carbocations, phenonium ions, and norboronyl system. S_Ni mechanism–structure and reactivity–phase transfer catalysis–ambident nucleophile, regiospecificity.

Aromatic substitution reactions: The arenium ion mechanism – orientation and reactivity, energy profile diagrams. Ortho–para ratio, ipso attack, orientation in other ring systems, quantitative treatment of reactivity in substrates and electrophiles. diazo coupling, Vilsmier reaction, Gattermann Koch reaction.

S_NAr, S_Ni, S_N2', Benzyne and $S_{RN}1$ mechanisms and reactivity–effect of substrate structure, leaving group and attacking nucleophile.

UNIT–III ADDITION REACTIONS 15 Hrs

Addition to C–C multiple bonds: Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio and chemo selectivity, orientation and reactivity. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration. Michael reaction. Shapeless asymmetric epoxidation.

Addition to carbon–hetreo atom multiple bonds: Addition of Grignard reagents, organo Zinc and organo Lithium reagents to carbonyl and unsaturated carbonyl compounds, Wittig reaction. Mechanism of condensation reactions involving enolates–Aldol, Knoevenagal, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions.

UNIT–IV ELIMINATION REACTIONS 15 Hrs

E_1, E_2, E_1CB mechanism, reactivity–Hoffman & Zaitsev rules, competition between elimination and substitution, mechanism and orientation in pyrolytic eliminations.

Typical reactions–dehydration, dehydrohalogenation, Chugaev reaction, Hofmann degradation and Cope elimination. Elimination reactions in organic synthesis.

References

1. Jerry March, Advanced Organic Chemistry, Wiley–VCH, Weinheim, 2000.
2. F.A. Carey and R.J. Sunberg, Advanced Organic Chemistry, Part–A & B, Plenum press, 2000.
3. E.L. Eliel, Stereochemistry of Carbon Compounds, John Wiley, 1997.
4. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International, 1991.
5. P.S. Kalsi, Stereochemistry of Organic Compounds, Wiley Estern Ltd., New Delhi, 1992.
6. R.T. Morrison, R.N. Boyd and S.K. Battacharjee, Organic chemistry, 7th edition, Pearson, 2007.
7. I.L. Finar, Organic Chemistry, Vol–I & II Stereochemistry and the Chemistry of Natural Products, 5th edition, Pearson India, 2011.
8. Peter Sykes, Guide Book to Mechanism in Chemistry, Orient Longman, 2005.
9. S.H. Pine, Organic Chemistry, McGraw Hill, 1987.
10. R.O.C. Norman and J.M. Coxon, Principles of Organic Synthesis, Blackie Academic and Professional, London, 1993.

CHHT–103 THERMODYNAMICS AND KINETICS

UNIT–I CLASSICAL THERMODYNAMICS 15 Hrs

Partial molar properties : Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determination of these quantities. Concept and determination of fugacity. Activity, activity coefficient, Debye–Huckel theory for activity coefficient of electrolytic solutions–determination of activity and activity coefficient.

UNIT–II STATISTICAL THERMODYNAMICS 15 Hrs

Thermodynamic probability and entropy, Maxwell–Boltzmann, Bose–Einstein and Fermi–Dirac statistics. Partition functions–translation, rotational and vibrational partition functions. Calculation of thermodynamic properties (Energy, Heat capacities, Entropy, Work function, Pressure, Free Energy, Enthalpy) and equilibrium constant in terms of partition functions. Calculation of entropy of mono and diatomic gaseous molecules, Heat capacity: Einstein and Debye theory of heat capacity of solids.

UNIT–III CHEMICAL KINETICS 15 Hrs

Absolute reaction rate theory–Ionic reactions in solution–Primary and Secondary salt effect. General feature of fast kinetics–study of fast reactions by Laser flash photolysis, Flow techniques and Relaxation methods. Heterogeneous catalysis–catalytic activity of surfaces–Langmuir, Hinshelwood and Riedal–Elay mechanisms.

UNIT–IV SURFACE PHENOMENA 15 Hrs

Adsorption at surfaces–physisorption and chemisorption–desorption. Adsorption isotherms–Langmiur and BET isotherms. Determination of surface area. Classification of surface active agents and CMC. Gibbs adsorption isotherm. Physical methods of studying surfaces : UVPES, Electron Microscopy LEED, EELS, FEM techniques.

References

1. F.W. Sears and G.L. Salinger, Thermodynamics, Kinetic theory & Statistical Thermodynamics, Narosa Publications, 1986.
2. M.C. Gupta, Statistical Thermodynamics, New Age International, 2007.
3. D.N. Bajpai, Advanced Physical Chemistry, S. Chand Publishing, 1992.
4. R.P. Rastogi and R.R. Misra, An Introduction to Chemical Thermodynamics, Vikas Publ. House Pvt. Ltd., 2000.
5. J.C. Kuriacose and J. Rajaram, Thermodynamics for Chemistry, Shoban Lal Nagain Chand, New Delhi, 1986.
6. G.L. Agarwal, Basic Chemical Kinetics, Tata McGraw Hill, 1990.
7. K.J. Laidler, Chemical Kinetics, Tata McGraw Hill, 1990.
8. A.W. Adamson, Physical Chemistry of Surfaces, Wiley–Interscience, New York, 1976.

CHHT–104 ENVIRONMENTAL CHEMISTRY

UNIT–I NATURAL RESOURCES 15 Hrs

Natural resources and associated problems: Forest resources: Use and over-exploitation–deforestation. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over–utilization of surface and ground water, floods, drought, conflicts over water, dams–benefits and problems. Mineral resources: uses and exploitation–environmental effects of extracting and using mineral resources, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer–pesticide problems, Energy resources: Growing energy needs, renewable and non–renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT–II ECOSYSTEM & BIODIVERSITY 15 Hrs

Concept of an ecosystem–Structure and function of an ecosystem–Producers, consumers and decomposers–Energy flow in the ecosystem–Ecological succession–Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ocean estuaries). Biodiversity and its conservation: Introduction, definition–genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local levels. India as a mega–diversity nation. Hot–spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man–wildlife conflicts. Conservation of biodiversity: *in–situ* and *ex–situ* conservation of biodiversity

UNIT–III ENVIRONMENTAL POLLUTION 15 Hrs

Definition–causes, effects and control measures of Air pollution–Water pollution–Soil pollution–Marine pollution–Noise pollution–Thermal pollution–Nuclear pollution. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

UNIT–IV POLLUTION MONITORING & CONTROL METHODS 15 Hrs

Water quality parameters–dissolved oxygen (DO), biochemical oxygen demand (BOD), COD, & TOC, solids, metals, content of chloride, sulphate, phosphate, nitrate and micro–organisms.

Determination of air quality by AAS, IR, UV–Visible, Conductometric and Gas chromatography techniques.

References

1. S.E. Manahan, Enviromental Chemistry, 7th edition, Lewis Publishers, 1997.
2. B.K. Sharma & H. Kaur, Introduction to Environmental Pollution, Krishna Prakashan Media (P) Ltd., 2001.
3. B.K. Sharma and H. Kaur, Environmental Chemistry, Goel Publishing House, Meerut, 1996.
4. A.K. De, Enviromental Chemistry, New Age Internaitonal (P) Limited, Publisher, 1994.
5. S.M. Khopkar, Enviromental Pollution Analysis, Wiley–Eastern publishers, 1993.
6. Saxena, Environmental Biology and Toxicology, Rostogi Publications, 2005.
7. F.J. Welcher, Strandard Methods of Chemical Analysis, Vol. Ill, Van Nostrand Reinhold Co., 1996.
8. Balram Pani, Text book of Environmental Chemistry, I.K. International Publishing House Pvt. Ltd., 2007.
9. Colin Baird and Michael Cann, Environmental Chemistry, 5th edition, WH Freeman, 2012.

CHHP–105 Practical–I ORGANIC CHEMISTRY

I. QUALITATIVE ANALYSIS

Separation, purification and identification of a binary mixture

II. QUANTITATIVE ANALYSIS

1. Estimation of amines/phenols using bromate bromide solution
2. Determination Iodine and Saponification values of an oil sample.
3. Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method.

III. ORGANIC SYNTHESIS

Preparations involving two steps for synthesis of organic compounds.

1. Acetylation
2. Oxidation and reduction
3. Hydrolysis
4. Aromatic Electrophilic substitutions: Nitration and Halogenation.

References

1. A.I. Vogel's Text Book Of Practical Organic Chemistry, 5th edition, Longman Scientific & Technical, 1989.
2. Jag Mohan, Organic Analytical Chemistry–Theory And Practise, Narosa Publishing House, 2003.
3. F.G. Mann and B.C. Saunders, Practical Organic Chemistry, 4th edition, 1964.
4. N.S. Gnanapragasam and G. Ramamoorthy, Organic Chemistry Lab manual, S. Visvanathan & Co. Pvt. Ltd., 1998.
5. V.K. Ahluwalia and R. Agarwal, Comprehensive Organic Practical Chemistry-Preparation and Quantitative Analysis, University Press, 2000.

SECOND SEMESTER

CHHT–201 COORDINATION & ORGANO–METALLIC CHEMISTRY

UNIT–I THEORY OF COORDIANTION COMPOUNDS 15 Hrs

Review of valence bond and crystal field theories–Crystal field splitting, CFSE, spectrochemical series–application of *d*–orbital splitting to explain magnetic & spectral properties, ionic radii, heats of ligation, lattice energies, site preference energies and chelate effects. Molecular orbital theory of complexes involving only sigma bond and sigma and pi bonds.

UNIT–II ELECTRONIC SPECTRA OF TRANSITION METAL COMPLEXES 15 Hrs

Spectroscopic ground state–Russell and Saunder's term states for free ions and Mulliken's term states for complexes. Orgel and Tanabe–Sugano diagrams for transition metal complexes (d^1 to d^9 states), Electronic spectra of complexes. The hole formalism–calculation of D_q, B, B' and Beta parameters. Charge transfer spectra in octahedral and tetrahedral complexes. Jahn–Teller Theorem, Jahn–Teller distortion and its effect on the electronic spectra of complexes. Cotton effect–CD and ORD and their applications.

UNIT–III CHEMISTRY OF COORDINATION AND ORGANO–METALLIC COMPOUNDS 15 Hrs

18–electron rule–transition metal carbonyls: structure, bonding and chemistry of metal carbonyls. General methods of preparation, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes, metallocenes, metal alkyl and aryl complexes.

Oxidative addition and reductive elimination, insertion reactions, olefin hydrogenation, hydroformylation, Wacker process, Ziegler–Natta polymerisation, Fischer–Tropsch process.

UNIT– IV REACTION MECHANISM OF TRANSITION METAL COMPLEXES 15 Hrs

Energy profile of the reactions, reactivity of metal complexes, inert and labile complexes, kinetic application of VB and CF Theories. Kinetics of octahedral substitutions, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism. Anation reaction, reactions without metal–ligand bond cleavage, substitution reactions in square planar complexes, theories of trans effect, mechanism of the substitution reaction, redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outersphere type reactions, cross reactions and Marcus–Hush theory, inner sphere type reactions.

References

1. J.E. Huheey, Inorganic Chemistry–Principle, Structure and Reactivity, 4th edition, Harper Collins. College Publishers, New York, 1993.
2. B. Douglas, D. McDaniel and J.J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd edition, John Wiley & Sons, Blaisdell Publishing Co., 1995.
3. P.W. Atkins, D.K. Shriver and C.H. Langford, Inorganic Chemistry, 3rd edition, Oxford University Press, 1999.
4. L.V. Azaraff, Introduction to Solids, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1993.
5. A.F. Wells, Structural Inorganic Chemistry, 5th edition, Oxford University Press, New York, 1984.
6. H.J. Arnikar, Essentials of Nuclear chemistry, 2nd edition, New Age International, 1995.
7. S. Glasstone, Source Book of Atomic Energy, Affiliated East West Press, New Delhi, 1969.
8. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, 2nd edition, Reinhold Publishing Corp., 1962.
9. F.A. Cotton and G. Willkinson, Advanced Inorganic Chemistry, John Wiley & Sons, 1988.
10. J.D. Lee, Concise Inorganic Chemistry, 5th edition, Chapman & Hall, London, 1997.
11. B.N. Figgis, Introduction to Ligand Fields, John Wiley & Sons Ltd., London, 1966.
12. D. Bannerje, Coordination Chemistry, Tata McGraw Hill, 1993.
13. S.F.A. Kettle, Coordination Compounds, Thomas Nelson & Sons Ltd, 1969.
14. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Reinhold, New York, 1970.
15. R.S. Drago, Physical Methods in Inorganic Chemistry, Saunders, 1992.

CHHT–202 ORGANIC REACTION MECHANISMS

UNIT–I ORGANIC REACTION MECHANISMS: STRUCTURE AND REACTIVITY 15 Hrs

Types of reactions, types of mechanisms, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin–Hammet principle, potential energy diagrams, transition states and intermediates, methods of determining mechanism, isotopic effects, hard and soft acids and bases.

Effect of structure on reactivity–resonance and field effects, steric effect, quantitative treatment. Hammet equation and linear free energy relationships, substituent and reaction constants, Taft equation.

UNIT–II OXIDATION AND REDUCTION REACTIONS 15 Hrs

Mechanism and study of the following reactions: Oxidation with Chromium, Manganese, Osmium, Lead, Ruthenium and Selenium.

Reductions: catalytic hydrogenation, metal hydride reduction ($LiAlH_4$, $NaBH_4$ and their derivatives), Metal ammonia reduction, selectivity in reduction.

UNIT–III CONCERTED REACTIONS 15 Hrs

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3–butadiene, 1,3,5–hexatriene and allyl systems. Classification of pericyclic reactions. Woodword–Hoffman correlation diagrams, FMO and PMO approach. Electrocyclic reactions–*con* and *dis* rotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions–antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketene, 1,3–dipolar cycloadditions and chelotropic reactions.

Sigmatropic rearrangements–suprafacial and antarafacial shifts of H, sigmatropic shifts involving carbon moieties, 3,3– and 5,5–sigmatropic rearrangements. Claisen, Cope and Oxy–Cope rearrangements.

UNIT–IV ORGANIC PHOTOCHEMISTRY AND REARRANGEMENT REACTIONS 15 Hrs

Introductory theory–Jablanski diagram, Norrish Type–I and Type–II, study of the photochemical reactions of carbonyl compounds, photoreductions, photocycloadditions and photorearrangements; di–π methane rearrangement.

Study of the rearrangement reactions: Paterno–Buchi, Favorski, Fries and Barton reactions.

References

1. Jerry March, Advanced Organic Chemistry, Wiley–VCH, Weinheim, 2000.
2. F.A. Carey and R.J. Sunberg, Advanced Organic Chemistry, Part–A & B, Plenum press, 2000.
3. R.T. Morrison and R.N. Boyd, Organic chemistry, 6th edition, Printice Hall, 1992.
4. Stanely H. Pine, Organic Chemistry, 5th edition, McGraw Hill, 1987.
5. S.M. Mukerji, Pericyclic Reactions, Macmillan Company of India, 1979.
6. S.M. Mukerji and S.P. Singh, Reaction Mechamism In Organic Chemistry, Macmillan Company of India, 1984.
7. A. Cox and T.J. Kemp, Introductory Photochemistry, McGraw–Hill, 1971.
8. R. Hoffmann, R.B. Woodward, The Conservation of Orbital Symmetry, Academic Press, 2014.
9. J.D. Coyle, Organic Photochemistry, Wiley, 1985.
10. I.L. Finar, Organic Chemistry, Vol–I & II Stereochemistry and the chemistry of natural products, Fifth Edition, Pearson India, 2011.
11. P.S. Kalsi, Organic Reaction and their Mechanism, New Age, 1996.

CHHT–203 ELECTROCHEMISTRY AND QUANTUM CHEMISTRY

UNIT–I ELECTROCHEMISTRY–I **15 Hrs**

Debye–Huckel–Onsager equation and its verification. Debye–Huckel limiting law. Debye–Huckel Jerrum models. Elecrode–Electrolyte interface–Electrokinetic phenomena. Ion–solvent interaction–Born model, Enthalpy, Free Energy, Entropy of ion solvent interactions. Primary and secondary salvations (Salting in and Salting out).

UNIT–II ELECTROCHEMISTRY–II **15 Hrs**

Electrode kinetics–Butler–Volmer Equation, Tafel Equation, Polarography theory, Ilkovic equation, Half wave potential and its significance. Surface electrochemistry–Electrical double layer, Helmholtz, Perkin, Gouy–Chapmann, Stern theories, Electro–capillarity, Lippmann equation (Surface excess).

UNIT–III QUANTUM CHEMISTRY–I **15 Hrs**

Failure of classical mechanics and need for quantum mechanics–Black body radiation, Photoelectric effect, Compton effect, wave particle duality, unceretainity principle–Operators: sum and product of operators, Linear, Differential, Hermitian and Hamiltonian operators. Commutator operators such as (x, P_x), (P_x, P_y), (L_x, L_y) & (L, L_x) and their significance. Eigen functions and Eigen values. Orthogonality and Normalization. Postulates of quantum mechanics. Time–dependent and time–independent Schrodinger wave equations.

UNIT–IV QUANTUM CHEMISTRY–II **15 Hrs**

Applications of wave mechanics–Schrodinger wave equation to free particles, Particle in a box (ID, 2D & 3D), Particle in a ring and sphere, Angular momentum–Rigid Rotor: Wave equation and solution, Simple Harmonic Oscillator (1 D): wave equation and solution.

References

1. John O'M. Bockris and Amulya K. N. Reddy, Modern Electrochemistry, Vol. I & II, Plenum, New York,1998.
2. P.H. Reiger, Electrochemistry, Prentice Hall, 1987.
3. A.J. Bird & L.R. Faulker, Electrochemical Methods, Fundamental and Applications, John Wiely, 1980.
4. F.L. Pillar, Elementary Quantum Chemistry, Mc Graw Hill, 1968.
5. E. Kreyzig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 2006.
6. R.K. Prasad, Quantum Chemistry through Problems and Solutions, New Age International, 1997.
7. Levine, Quantum Chemistry, IV Edn. Allyn. & Bacon Inc. 1983.
8. R.K. Prasad, Quantum Chemistry, New Age International, 2012.
9. B.K. Sen, Quantum Chemistry, Tata Mc Graw Hill, 1992.
10. F.L. Pilar, Elementary Quantum Chemistry, 2nd edition, Dover Publications, NY, 1990.

CHHT–204 POLYMER CHEMISTRY

UNIT–I POLYMER CHARACTERISATION 15 Hrs

Polymerisation process and mechanism: condensation, addition, radical, chain, ionic and coordination and co–polymerisation. Kinetics of addition (anionic, cationic and free radical) and condensation (step growth) polymerization–degree of polymerization. Molecular weight concept–Number, weight and viscosity average molecular weights. Polydispersity and molecular weight distribution, molecular weight determination by viscosity, light scattering, osmotic and ultra centrifugation methods.

UNIT–II STRUCTURE AND PROPERTIES 15 Hrs

Morphology and order in crystalline polymers–configurations of polymer chains. Crystal structure of polymers. Morphology of crystalline polymers, strain induced morphology, crystallisation and melting. Polymer structure and physical properties–crystalline melting point T_m, melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion, The glass transition temperature, T_g–relationship between T_m and T_g, effects of molecular weights, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilisation.

UNIT–III POLYMER PROCESSING 15 Hrs

Plastics, elastomers and fibers. Compounding. Processing techniques–calendaring, dye casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, reinforcing and fibre spinning. Analysis and testing of polymers–chemical analysis of polymers, spectroscopic methods, microscopy, thermal analysis and physical testing–strength, fatigue, impact. Tear resistance hardness and abrasion resistance.

UNIT–IV APPLICATIONS OF COMMERCIAL POLYMERS 15 Hrs

Polyethylene, PVC, Polyamides, Polyesters, Phenolic resins, Epoxiresins, Silicone polymers. Functional polymers–Fire retarding polymers and electrically conduction polymers. Biomedical polymers–contact lenses, dental polymers, artificial heart, kidney, skin and blood cells.

References

1. F.W. Billmeyer, Text Book of Polymer Science, Wiley–Interscience, New York. 1971.
2. V.R. Gowariker, N.V. Viswanathan & J. Sreedhar, Polymer Science, John Wiley & Sons, New York, 1986.
3. K. Takemoto, Y. Inaki & R.M. Ottanbrite, M. Kamachi, Functional Monomers & Polymers, CRC Press, 1997.
4. H.R. AIcock & F.W. Lambe, Contemporary Polymer Chemistry, Prentice Hall, USA.
5. J.M.G. Cowie, Physics & Chemistry of Polymers, Blacke Academic Press, 1993.

CHHP–205 Practical–II INORGANIC CHEMISTRY

I. QUALITATIVE AND QUANTITATIVE ANALYSIS

1) Qualitative analysis of less common metal ions : Se, Te, W, Ti, Mo, Ce, Th, Zr, V, U and Li. (Two metal ions in cationic/anionic forms)
2) Quantitative determination of two metal ions :
   1. Analysis of ores (Dolomite)
   2. Analysis of alloys (Magnalium, brass, stainless steel)
   3. Mixtures of Cu and Ni, Cu and Zn.

II. PREPARATION AND ANALYSIS OF INORGANIC COMPOUNDS

Preparation of selected inorganic compounds and their electronic spectral analysis.

1. $[Cu(NH_3)_4]SO_4.H_2O$
2. $K_3[Fe(OX)_3]$
3. Prussian Blue
4. $[Ni(NH_3)_6]Cl_2$
5. $[Ni(DMG)_2]$

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II M.Sc CHEMISTRY
THIRD SEMESTER

CHHT–301 BIOINORGANIC & INORGANIC PHOTOCHEMISTRY

UNIT–I ESSENTIAL AND TRACE ELEMENTS IN BIOLOGICAL PROCESSES 15 Hrs

Periodic survey of essential and trace elements–Major biological functions of the bulk biological elements, trace and ultra–trace elements. Sodium/potassium pump, DNA replication, biological fixation of nitrogen. Photosynthesis–structure and function of chlorophyll.

UNIT–II METALLOENZYMES 15 Hrs

Zn enzymes–carboxypeptidase and carbonic anhydrase. Iron enzymes–catalase, peroxidase and cytochrome P–450. Copper enzymes–superoxide dismutase. Molybdenum oxatransferase enzymes – xanthine oxidase. Co–enzyme vitamin B–12.

UNIT–III DIOXYGEN AND ELECTRON TRANSFER IN BIOLOGY 15 Hrs

Heme proteins and oxygen uptake. Structure and function of haemoglobin, myoglobin, haemocyanins and haemerythrin. ferredoxin and rubredoxins . Structure and function of metalloproteins in electron transport processes–cytochromes and iron–sulphur proteins.

UNIT–IV PHOTOCHEMICAL REACTIONS OF TRANSITION METALS 15 Hrs

Basic photophysical and photochemical processes–Thermal effects of photoluminescence photosubstitution–Adamson's rule–photoredox reactions. Methods to study rates of reactions occurring in solutions. Charge transfer spectra and methods for obtaining charge transfer spectra.

References

1. James E. Huheey, Inorganic Chemistry–Principle, Structure and Reactivity, 4th edition, Harper Collins. College Publishers, New York, 1993.
2. K.F. Purcell, & J.C. Kotz, Inorganic Chemistry, W.B. Saunders and Co., New York, 1977.
3. S.J. Lippard, & J.M. Berg, Principles of Bioinorganic Chemistry, Panima Publishing Corporation, 1997.
4. W.W. Porterfield, Inorganic Chemistry: A Unified Approach, Addison–Wesley Pub Co., 1984.
5. G.L. Eichhorn (Ed.), Inorganic Biochemistry, Vol. I & II, Elsevier, 1973.
6. V. Balzari and V. Carassiti, Photochemistry of Coordination Compounds, Academic Press, New York, 1970.
7. G.J. Ferraudi, Elements of Photochemistry, Wiley–Interscience, 1988.

CHHT–302 ORGANIC SPECTROSCOPY & SPECTROMETRY

UNIT–I APPLICATIONS OF MASS SPECTROMETRY 15 Hrs

Basic principles of Mass spectrometry, modem techniques of Ionisation, molecular ion, isotope abundance, Nitrogen rule, double bond equivalent, daughter ions, metastable ions, McLafferty rearrangement, common fragmentation pathways. Structure determination of organic compounds by Mass spectral data.

UNIT–II APPLICATIONS OF UV–VISIBLE AND IR SPECTROSCOPY 15 Hrs

Study of UV–Visible Spectroscopy to organic structure determination–Woodward–Fischer rules, Applications of ORD–CD to stereo chemical assignment. Cotton effect; Octant rule and Axial haloketone rule.

IR spectroscopy–Characteristic frequencies of common functional groups. Effect of Hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance.

UNIT–III APPLICATIONS OF NMR SPECTOSCOPY 15 Hrs

Basic principles, introduction to NMR techniques: CW and FT–NMR techniques. ^{1}H NMR Spectral parameters–Intensity, Chemical shift, multiplicity, Coupling constant, factors affecting. Analysis of first and second order spectra. Structure determination of organic compounds by ^{1}H NMR. Simplification of complex spectra.

^{13}C NMR– Proton coupled, off resonance decoupled, proton noise decoupled ^{13}C NMR spectra. Assignment of chemical shifts, additive effect, characteristic chemical shift of common organic compounds and functional groups. DEPT and SEPT spectra (elementary treatment).

2D NMR Techniques: ^{1}H–^{1}H COSY, ^{1}H–^{13}C COSY and NOESY (with examples). HMQC and HMBC (only techniques).

UNIT–IV PROBLEMS IN SPECTROSCOPY 15 Hrs

Spectroscopic identification of Organic compounds–Characterisation of organic compounds using UV, IR, Mass and NMR data – related problems.

References

1. William Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, 1994.
2. R.M. Silverstein and F.X. Webster, Spectrometric Identification of Organic Compounds, John Wiley, 1997
3. William Kemp, NMR in Chemistry: A Multinuclear Introduction, Macmillan, 1988.
4. D.H. Williams and Ian Fleming, Spectroscopic Methods in Organic Chemistry, Tata McGraw Hill, 1998.
5. D. Pavia, G. Lampman and G. Kriz, Introduction to Spectroscopy, Thompson Brooks/Cole, 2001.
6. R.S. Drago, Physical Methods in Inorganic Chemistry, Saunders, 1992.

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CHHT–303 QUANTUM CHEMISTRY AND GROUP THEORY

Unit–I QUANTUM CHEMISTRY–III **15 Hrs**

The hydrogen atom and hydrogen like ions: Solution to H and H–like wave equation, radial and angular functions, the radial distribution functions, Zeeman effect, Variation and Perturbation methods and its application to Hydrogen and Helium atom, Hydrogen atom in an electric field, Antisymmetric wave functions of many electron atoms, Pauli exclusion principle and Slater determinants.

Unit–II QUANTUM CHEMISTRY–IV **15 Hrs**

Hartree–Fock self consistent field model for atoms and molecules (Advanced MO methods). Slater determinants for molecules, Born Oppenheimer approximation. LCAO, MOT for H_2^+ ion and VBT for H_2 molecule. Simple Huckel theory for π–electrons and its application to ethylene, allyl, butadiene and benzene systems, Hybrid constructions for sp and sp^2 systems.

Unit–III GROUP THEORY IN CHEMISTRY **15 Hrs**

Symmetry elements and symmetry operation, definitions of group, subgroup, relation between orders of a finite group and its subgroup, conjugacy relation and Classes. point groups and their systematic classification–flow chart diagram–multiplication table–representation of groups–reducible and irreducible representations–character table and their construction for C_{2v} and C_{3v} – great orthogonality theorem (without proof) and its consequences. Applications of character tables to predict molecular vibrations (IR and Raman) for water and ammonia.

Unit–IV VIBRATIONAL AND ROTATIONAL SPECTROSCOPY **15 Hrs**

Classification of molecules, selection rules for rotational spectrum–rigid rotor model, effect of isotopic substitution on the transition frequencies, non–rigid rotor. Vibrational energies of diatomic molecules, force constant, band strength. Selection rules–energy of anharmonic oscillator–fundamental, first and second overtones and hot bands. Vibration–rotation spectroscopy–origin of PQR branches, normal mode of vibrations (e.g. H_2O & CO_2), Fermi resonance and group frequencies. Raman spectra: Classical and quantum theories of Raman effect, pure rotational, vibrational and vibration–rotational Raman spectra, selection rules–mutual exclusion principle–Resonance Raman spectroscopy.

References

1. D.A. McQuarrie, Quantum Chemistry, Oxford University Press, Oxford, 1983.
2. A.K. Chandra, Introductory Quantum Chemistry, Tata McGraw Hill, 1989.
3. F.A. Cotton, Chemical Applications of Group Theory, Wiley Eastern, 1985.
4. M.S. Gopinathan and V. Ramakrishnan, Group Theory In Chemistry, Vishal Publishing Company, 2013.
5. Alan Vincent, Molecular Symmetry and Group Theory: A Programmed Introduction to Chemical Applications, John & Wiley and Sons Ltd., 1997.
6. C.N. Banwell, Molecualr Spectroscopy, Tata–Mcraw Hill, 1998.
7. IRA N. Levine, Quantum Chemistry, IV Edn., Allyn. & Bacon Inc., 1983.
8. R.K. Prasad, Quantum Chemistry, IV Edn., New Age International Publishers, 2012.
9. G.W. Castellan, Physical Chemistry, 3rd Edition, Narosa Publishing House, 2004.
10. G. M. Barrow, Introduction to Molecular Spectroscopy, McGraw Hill, 1962.
11. M. Tinkham, Group Theory and Quantum Mechanics, McGraw Hill, 1964.
12. Frank L. Pilar, Elementary Quantum Chemistry, 2nd edition, McGraw–Hill Publishing Company, 1990.
13. P.W. Atkins and R.S. Friedman, Molecular Quantum Mechanics, 3rd edition, Oxford University Press, 1997.
14. Raymond Chang, Basic Principles of Spectroscopy, McGraw-Hill Inc., US, 1971.

CHHT–304 PHARMACEUTICAL CHEMISTRY

Unit–I INTRODUCTION 15 Hrs

Concept of drug, lead compound and lead modification, prodrugs and soft drugs; Structure–activity relationship (SAR), quantitative structure–activity relationship (QSAR); Factors affecting bioactivity–resonance, inductive effect, isosterism, bio–isosterism, spatial considerations; Theories of drug activity–occupancy theory, rate theory, induced fit theory. Concept of drug receptors–elementary treatment of drug–receptor interactions; Factors affecting modes of drug administration, absorption, metabolism and elimination.

Unit–II ANTIBIOTICS 15 Hrs

Cell wall biosynthesis, inhibitors of β–lactam rings, antibiotics inhibiting protein synthesis; Isolation, structure elucidation, synthesis, SAR and mode of action of penicillins; Synthesis of penicillin–G, penicillin–V, ampicillin, amoxicillin and cephalosporin. Isolation, structure elucidation, synthesis, SAR and mode of action of following antibiotics: streptomycin and tetracyclines.

Unit–III DRUG TYPES–I 15 Hrs

(a) Antineoplastic drugs: Cancer chemotherapy, role of alkylating agents and antimetabolites in the treatment of cancer; Carcinolytic antibiotics and mitotic inhibitors; Synthesis of 5–bromouracil and 6–mercaptopurine. Anticancer action of taxol.

(b) Cardiovascular drug: Classification, synthesis and mode of action of methyldopa and buphenine.

(c) Hypnotics and sedatives: SAR and mode of action; Synthesis of diazepam, oxazepam, chlorazepam, alprazolam, barbiturates.

(d) Local anaesthetics: Classification, SAR and mode of action. Synthesis of procaine, α–eucaine, xylocaine and quinisocaine.

Unit–IV DRUG TYPES–II 15 Hrs

(a) Antiinfective drugs: Mode of action and synthesis of ciprofloxacin, norfloxacin, daspone, isoniazide.

(b) Antipyretic analgesics: Classification and mode of action of antipyretic analgesics; Synthesis of paracetamol, chincophan, Novalgin and mefenamic acid.

(c) Antihistamines: SAR and mode of action of HI–receptor antagonists; Synthesis of methapyriline, antazoline, promethazine and phenindamine.

(d) Antimalarial drug: Nitrogen heterocycles as antimalarial agents, their classification and mode of action, synthesis of chloroquine, pamaquine, Mepacrine and pyrimethamine.

References

1. H. Kubinyiin M. Wolff (Ed.), Burger's Medicinal Chemistry and Drug Discovery, Vol. 1: Principles and Practice, John Wiley & Sons, New York, 1995.
2. Goodman & Gilman. Pharmacological Basis of Therapeutics, McGraw–Hill, 2005.
3. S.S. Pandeya & J.R. Dimmock, Introduction to Drug Design, New Age International, 2000.
4. G.L. Patrick, An Introduction to Medicinal Chemistry, 3rd edition, Oxford University Press, 2005.
5. D. Lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, 1998.
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7. D. Smith, D. Walker, H. van de Waterbeemd, Pharmacokinetics and Metabolism in Drug Design, Wiley–VCH, 2001.

CHSC–305A INDUSTRIAL CHEMISTRY

UNIT–1 FERTILIZERS **15 Hrs**

Plant nutrients–macro & micronutrients–Need for fertilizers–Fertilizers type–Essential requirements–Classification of fertilizers–simple and mixed fertilizers–Sources–Natural and Artificial fertilizers–Nitrogenous fertilizers–Ammonium nitrate, Ammonium sulphate, Urea, CAN, Calcium cyanamide (Method of preparation and uses). Phosphate fertilizers–Super phosphate and triple super phosphate–Method of preparation & uses. Potash fertilizers–KNO_3 : method of preparation and uses. Mixed fertilizers–preparation & uses. NPK ratio and its importance.

UNIT–2 GLASS **15 Hrs**

Introduction–physical & chemical properties of glass–characteristics–raw materials–method of manufacture–chemical reaction in the glass furnace–some special glasses–fused silica glass, High silica glass, Optical glass, Borosilicate glass, Lead glass, alkali silica glass, coloured glass, Opal glass, safety glass, fibre glass, glass wool, pyrex glass, Bottle glass photosensitive glass.

UNIT–3 CERAMICS & REFRACTORIES **15 Hrs**

CERAMICS: Introduction–classification–general properties–raw materials–manufacture–glazing.

REFRACTORIES: Introduction–classification–properties–manufacture; Fire clay bricks–manufacture–preparation of fire clay refractories–High Alumina refractories–Uses of Silliminite refractories–Graphite refractories–property and uses only.

UNIT–4 CEMENT **15 Hrs**

Introduction–raw materials–Different types of Kilns and uses–Manufacture and uses : Slag cement, Acid resisting cement, White cement–additives to cement–setting of cement–properties of cement.

Concrete–preparation of concrete, curing of cement. Decay of cement–corrosion of concrete.

References

1. B.K. Sharma, Industrial Chemistry, 15th edition, Goel Publishing House, 2006.
2. P.C. Jain & Monica Jain, Engineering Chemistry, Dhanpat, Rai Publications, 2009.
3. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Inorganic Chemistry, Vishal Publishing Co., 2017.
3. A. Heaton, An Introduction to Industrial Chemistry, Chapman & Hall Pub. Co., 1996.
4. P.L. Soni, A Text Book of Inorganic Chemistry, Sultan Chand, 2013.
5. S. Mohan, V. Arjunan and Sujin P. Jose, Principles of Materials Science, MJP Publishers, Chennai, 2018.

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CHSC–305B CHEMISTRY OF CONSUMER PRODUCTS

UNIT–1 SOAPS 15 Hrs

Saponification of oils and fats, Manufacture of soaps, Formulation of toilet soaps, Different ingredients used and their functions. Medicated soaps, Herbal soaps, Mechanism of action of soap, Soft soaps, Shaving soaps and creams, ISI specifications, Testing procedures / limits.

UNIT–2 DETERGENTS 15 Hrs

Anionic detergents: Manufacture of LAB (linear alkyl benzene), Sulphonation of LAB– preparation of acid slurry, different ingredients in the formulation of detergent powders and soaps, Liquid detergents, Foam boosters, AOS (alpha olefin sulphonates).

Cationic detergents: examples, Manufacture and applications. Non–ionic detergents: examples, manufacture of ethylene oxide condensater. Mechanism of action of detergents, Comparison of soaps and detergents, Biodegradation–environmental effects, ISI specifications / limits

UNIT–3 SHAMPOOS 15 Hrs

Manufacture of SLS and SLES, Ingredients, Functions. Different kinds of shampoos : anti–dandruff, anti–lice, herbal and baby shampoos, Hair dye, Manufacture of conditioners, Coco betains or coco diethanolamides–ISI specifications, Testing procedures and limits.

UNIT–4 SKIN PREPARATIONS 15 Hrs

Face and skin powders, Ingredients, functions, different types, snows and face creams, chemical ingredients used, anti perspirants, sun screen preparations, UV absorbers, Skin bleaching agents, Depilatories, turmeric and Neem preparation, Vitamin oil, Nail polishes: nail polish preparation, nail polish removers, Article removers, Lipsticks, roughes, eyebrow pencils, ingredients and functions–hazards, ISI specifications.

References

1. S. Gobala Rao, Outlines of Chemical Technology, Affiliated East West press, 1998.
2. Kafaro, Wasteless chemical processing, Mir publishers, 1995.
3. W. Sawyer, Experimental Cosmetics, Dover publishers, New York, 2000.

CHHP–306 Practical–III PHYSICAL CHEMISTRY

1. KINETICS

a) Determination of the activation energy of acid catalysed hydrolysis of aliphatic ester.

b) Effect of ionic strength on rate of reaction between persulphate and iodide.

c) Kinetics of saponification of ester and determination of its order of reaction.

d) Kinetic study on iodination of acetone in the presence of an acid.

2. **PHASE EQUILIBRIA**

a) Congruent system— diphenyl amine & benzophenone

b) Phase diagram of Ternary system

3. **DISTRIBUTION LAW**

a) Molecular formula of Cu–NH_3 complex by partition coefficient method.

b) Study of equilibrium constant of the reaction: $Kl + I_2 == KI_3$

c) Association factor of Benzoic acid

4. **CONDUCTIVITY EXPERIMENTS**

a) Determination of Solubility and solubility product of sparingly soluble salts $PbSO_4$ and $BaSO_4$.

b) Determination of the concentration of a given strong acid by conductometric titration.

c) Determination of the concentration of a given weak acid by conductometric titration.

d) Precipitation Titrations

e) Mixture of strong and weak acids with a strong base

5. **POTENTIOMETRIC EXPERIMENTS**

a) Redox Titrations

b) Solubility product of sparingly soluble salt

c) Mixture of halides with sliver nitrate

d) Determination of P^H of buffer solution.

References

1. D.P. Shoemaker, C.W. Garland and L.W. Niber, Experimental Physical Chemistry, McGraw Hill, New York, 2003.
2. B.P. Levett, FINDLAY'S Practical Physical Chemistry, 9th edition, Longman Group Ltd., 1973.
3. J.C. Ghosh, Bharathi Bavan, Experiments in Physical Chemistry.
4. B. Viswanathan and P.S. Raghavan, Practical Physical Chemistry, VIVA Books Pvt. Ltd., New Delhi, 2005.

FOURTH SEMESTER

CHHT–401 TECHNIQUES IN INORGANIC CHEMISTRY

UNIT–1 ANALYTICAL TECHNIQUES 15 Hrs

Thermal methods of analysis: TGA, DTA and DSC. Chromatographic techniques: Open column, HPLC, ion–exchange, size exclusion and GLC. Atomic absorption and flame emission spectroscopies. Characterisation of inorganic compounds by UV–Visible, NQR and Mass spectrometry.

UNIT–II RADIOANALYTICAL TECHNIQUES 15 Hrs

Particle accelerators: Linear accelerators, cyclotrons, synchrocyclotrons and betatrons. Counting techniques: G.M. counter, Scintillation counter, Cherenkov counter, cloud and bubble chamber counters. Neutron activation and isotopic dilution analysis.

UNIT–III PHYSICAL METHODS IN INORGANIC CHEMISTRY 15 Hrs

Nuclear magnetic resonance spectroscopy : Principles, Instrumentation, Applications of ^{1}H, ^{15}N, ^{19}F, ^{31}P NMR–spectroscopies in the structural assessment of inorganic compounds.

Mossbauer Spectroscopy: Principles, isomer shift, quadrupole effect of magnetic field, applications to iron compounds. Basics of Photoelectron and Auger spectroscopies. Characterisation of inorganic compounds by IR, Raman and EPR techniques.

UNIT–IV MAGNETIC PROPERTIES 15 Hrs

Introduction–Dia, Para, Ferro, Antiferro and Ferrimaganetism–Determination of magnetic suscepletibility by Guoy's and Faraday's methods. Magnetic properties of complexes–spin only values, Orbital contribution to the magnetic moment, Quenching of orbital contribution and spin–orbital coupling. Abnormalities in the magnetic moments of the complexes of metals of 2^{nd} and 3^{rd} transition series. Simple calculations of magnetic moments using spin only formula, orbital contribution and spin–orbit coupling formulae.

References

1. James E. Huheey, Inorganic Chemistry–Principle, Structure and Reactivity, 4th edition, Harper Collins. College Publishers, New York, 1993.
2. B. Douglas, D. McDaniel and J.J. Alexander – Concepts and Models in Inorganic Chemistry, 3^{rd} edition, John Wiley & Sons, Blaisdell Publishing Co., 1995.
3. P.W. Atkins, D.K. Shriver and C.H. Langford, Inorganic Chemistry, 3^{rd} edition, Oxford University Press, 1999.

4. D.A. Skoog, J.J. Leary, Principles of Instrumental Analysis, 4th edition, Saunders College Publishing, New York, 1992.
5. GD Christian and JE O'Reilly, Instrumental Analysis, Allyn and Bacon, 1986.
6. R.D. Braun, Introduction to Instrumental Analysis, McGraw–Hill International, New York, 1987.
7. H.J. Arnikar, Essentials of Nuclear Chemistry, 2nd edition, Wiley, 1987.
8. S. Glasstone, Source Book on Atomic Energy, Von Honstrand, 1958.
9. R.V. Parish, NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, Ellis Horwood, New York, 1990.
10. R.S. Drago, Physical Methods in Inorganic Chemistry, Saunders College Publishers, 1977.

CHHT–402 ORGANIC SYNTHESIS & REACTIONS

UNIT–I ORGANIC SYNTHETIC METHODOLOGY–I 15 Hrs

An introduction to synthons and synthetic equivalents, disconnection approach, functional group interconversions. the importance of the order of events in organic synthesis, one group C–X and two group C–X disconnections, Chemoselectivity, reversal of polarity, cyclization reactions, amine synthesis. Principle of protection of alcohols, amines, carbonyl and carboxyl groups.

UNIT–II ORGANIC SYNTHETIC METHODOLOGY–II 15 Hrs

One group C–C disconnections–Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds inorganic synthesis. Two group C–C disconnections–Diels–Alder reaction, Michael Addition, and Robinson annelation, Stark–Enamine reaction. Synthetic applications of the following Name reactions / mechanisms: (1) Neber; (2) Wittig rearrangement; (3) Stevens; (4) Somlet housher; (5) Nazarov; (6) Stiglitz; (7) Von Richer; (8) Smiles; (9) Heck.

UNIT–III SYNTHESIS OF ALKALOIDS, STEROIDS AND TERPENOIDS 15 Hrs

Isolation & importance of alkaloids–synthesis of quinine and morphine. Isolation, & importance of steroids–synthesis of the steroids–androgens, oestrogens. Isolation and importance of terpenes–synthesis of the terpenes–abietic acid and gibberellic acid (gibberllin–A).

UNIT–IV MACRO & BIOMOLECULES 15 Hrs

Carbohydrates : Cellulose and Starch; Lipids : Phospholipids and Cholesterol. Aminoacids, Peptides and Proteins–Structure and synthesis. Nucleic acids and Nucleotides: Structure and biochemistry. Anthocyanins–Cyanidin, Malvidin & Delphinidin chlorides.

References

1. Willium Kemp, Organic Spectroscopy, 3rd edition, Macmillan, 1994.
2. R.M. Silverstein and F.X. Webster, Spectrometric Identification of Organic Compounds, 7th edition, John Wiley & Sons, 2005.
3. W. Kemp, Introduction to Multinuclear NMR, Macmillan, London, 1986.
4. D.H. Willams and Ian Fleming, Spectroscopic Methods in Organic Chemistry, Tata McGraw Hill, New Delhi, 1998.
5. Donald L. Pavia, Gary M. Lampman, George S. Kriz and James A. Vyvyan, Introduction to Spectroscopy, 4th edition, Brooks Cole, USA, 2009.
6. R.O.C. Norman and J.M. Coxon, Principle of Organic Synthesis, 3rd edition, Blackie Academic & Pro., 1993.
7. Herbert O. House, Modern Synthetic Reactions: Organic Chemistry Monograph Series, 2nd edition, Publisher W. A. Benjamin, New York, 1972.
8. F.A. Carey and R.J. Sundberg, Advance Organic Chemistry, Part–B Reactions and Synthesis, 3rd edition, Plenum: New York, 1990.
9. I.L. Finar, Organic Chemistry, Vol–II Stereochemistry and the chemistry of natural products, Fifth Edition, Pearson India, 2011.

CHHT–403 SOLID STATE AND PHOTOCHEMISTRY

Unit–I SOLID STATE CHEMISTRY–I 15 Hrs

Solid Solutions: Substitutional, interstitial and subtractional solid solutions & distortions in crystal structures. Metals, insulators and semiconductors; Electronic structure of solids–band theory; intrinsic and extrinsic semiconductors, *p–n* junctions (diodes, LEDs, solar cells). Hall effect, thermoelectric effects (Thomson, Peltier and Seebeck), Insulators–dielectric, ferroelectric, pyroelectric and piezoelectric properties; Superconductors–Meissner effect, BCS theory. Electrically conducting organic solids–organic metals

Unit–II SOLID STATE CHEMISTRY–II 15 Hrs

Characterization of inorganic solids–X–ray diffraction, Electron diffraction. Non–stoichiometric defects: Origin of non–stoichiometry, consequences of non–stoichiometry; Equilibria in non–stoichiometric solids, Color centers: F–centre, electron and hole centre; colour centre and information storage. Amorphous materials, zeolites, fullerenes and nanocrystalline solids.

Unit–III NMR AND EPR SPECTROSCOPY 15 Hrs

Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurement, factors influencing chemical shift, deshielding, spin–spin interactions, factors influencing coupling constant 'J' classification (ABC, A_2B_2), spin decoupling, use of NMR in medical diagnostics. EPR Spectrum : Basic principles, Zero field splitting and Kramer's degeneracy, factors affecting the 'g' value, isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and McConnell relationship, application to simple free radicals in solutions.

UNIT–IV PHOTOCHEMISTRY 15 Hrs

Energy levels, Franck–Condon principle, Morse potential energy diagram, vibronic transitions. Types of photophysical pathways, Radiationless transitions, Fluorescence emission, Triplet state and phosphorescence emission, Fluorescence quenching, Stern–Volmer equation, Concentration quenching and excimer formation Lasers–principle of Laser action–population inversion–introduction to general lasers and their types. CW & Pulsed Lasers, YAG lasers, Neon and Argon lasers–Laser applications in medicine and surgery, materials processing, optical communication.

References

1. R.V. Parish, NMR, NQR, EPR and Mosssbauer Spectroscopy in Inorganic chemistry, Ellis Harwood Ltd., London, 1990.
2. A.R. West. Solid State Chemistry and its Applications, John Wiley, 1998.
2. D.K. Chakraborty, Solid State, New Age International, New Delhi, 1996.
3. C.E. Wayne & R.P. Wayne, Photochemistry, Oxford University Press, Oxford, 1996.
4. N.J. Turro, Modern Molecular Photochemistry, University Science Books, USA, 1991.
5. A. Gilbert & J.E. Baggott, Essentials of Molecular Photochemistry, Wiley–Blackwell, Oxford, 1991.
6. S. Mohan, V. Arjunan, M. Selvarani, M. Kanchana Mala, Laser Physics – An Insight into Medical and Cosmetic Photonics, MJP Publishers, Chennai, 2012.
7. S. Mohan, V. Arjunan, S. Gogulraj, Fiber Optics and Laser Instrumentation, MJP Publishers, Chennai, 2016.

CHHT–404A GREEN CHEMISTRY

UNIT–I GREEN REACTIONS 15 Hrs

Aldol condensation–Mechanism–Acid catalysed aldol condensation–Crossed Aldol condensation–Vinylogous Aldol condensation–Aldol condensation in solid phase–Arndt–Eistert synthesis–Mechanism and applications, Baeyer–Villiger oxidation–Mechanism, Migratory aptitude– Baeyer–Villiger oxidation in aqueous phase and solid phase, Enzymatic Baeyer–Villiger oxidation and its applications, Cannizaro reaction and its mechanism–Crossed Cannizaro reaction–Cannizaro reactions under sonication–applications, Diel's Alder reaction–Mechanism– Diel's Alder reactions under microwave conditions, in aqueous phase and in ionic liquids.

UNIT–II GREEN PREPARATION 15 Hrs

Microwave induced reactions on (a) 9,10–dihydroanthracene–endo–α–β–succinic anhydride (b) 3–methyl–1–phenyl–5–pyrazolone; Preparation of derivatives of some organic compounds, Rearrangement reactions–Benzopinacolone and 2–allyl phenol, Photochemical reactions–Benzopinacol–conversion of *trans*–stilbene to *cis*–stilbene, Enzymatic transformation, Ethanol and Benzoin, Esterification–Isopentyl acetate and methyl salicylate.

UNIT–III TRANSITION METAL CATALYSIS 15 Hrs

Homogeneous Transition metal catalysis: General considerations, Reason for selecting transition metals in catalysis (bonding ability, ligand effects, variability of oxidation state and coordination number), basic concept of catalysis (molecular activation by coordination and addition), proximity interaction (insertion/inter–ligand migration and elimination, rearrangement). Phase transfer catalysis. Homogeneous hydrogenation of unsaturated compounds (alkenes, alkynes, aldehydes and ketones). Some important homogeneous catalytic reactions–oligomerisation of alkenes by aluminumalkyl, Wackers acetaldehyde synthesis, hydroformylation of unsaturated compounds using cobalt and rhodium complexes, Monsanto acetic acid synthesis.

UNIT–IV ORGANO CATALYSIS 15 Hrs

Organocatalysis–Organo catalyst definition–classification–types of Lewis basic catalysis–Mukaiyama–Michael, Malonate, Dicarbonyl additions, Mannich reaction and Stetter reaction. Lewis acidic catalysis–Michael addition & epoxidation. Bronsted basic & Bronsted acidic catalysis–Desymmetrization & strecker reaction. Organocatalysis in total synthesis–(–)–Littoralisone.

References

1. I.L. Finar, Organic Chemistry, Vol–II Stereochemistry and the Chemistry of Natural Products, 5th edition, Pearson India, 2011.
2. K. Nakanashi. Natural Products Chemistry, Vols. I and II, Academic Press, New York, 1974.
3. G. Zhong Cao, Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press, 2004.
4. John Mann, Chemical Aspects of Biosynthesis, Oxford University Press, Oxford, 1996.
5. N.R. Krishnaswamy, Chemistiy of Natural Products: A Unified Approach, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
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7. Hari Singh Nalwa, Handbook of Nanostructured Materials and Nanotechnology, Academic Press, 2002.
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9. Robert A. Freitas Jr, Nanomedicine, Vol. IIA: Biocompatibility, Landes Bioscience, Georgetown, USA, 2003.
10. V.K. Ahluwalia, Green Chemistry, 1st edition, Ane Books Pvt. Ltd., 2016.

CHHT–404B FORENSIC CHEMISTRY

UNIT–1 FOOD ADULTERATION 15 Hrs

Contamination of wheat, rice, dhal, milk, butter, etc. With clay, sand, stone, water and toxic chemicals (e.g. Kasseri dhal with mentanil yellow). Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), Chemical poisons (KCN), First aid and Antidotes for poisoned persons. Heavy metal (Hg, Pb, Cd) Contamination of sea food, Use of neutron activation analysis in detecting poisoning (e.g., as in human hair)

UNIT–2 TRANSPORTATION 15 Hrs

Drunken driving, Brath analyser for ethanol, Incendiary and timed bombs in road and railway tracks, Defusing live bombs. Hit and go–traffic accidents. Paint analysis by AAS, Soil of toxic and corrosive chemicals (e.g., conc. acids) from tankers.

UNIT–3 CRIME DETECTION 15 Hrs

Accidental explosions during manufacture of matches and fire–works (as in Sivakasi) Human bombs, possible explosives (gelatin, RDX), Metal detector devices and other security measures for VVIP, Composition of bullets and detection of powder burns. Scene of crime: finger prints and matching using computer records, smell tracks and police dogs. Analysis of blood and other body fluids in rape cases, typing of blood, DNA finger printing for tissue identification in dismembered bodies, Blood stains on clothing, Cranial analysis (head and teeth).

UNIT–4 FORGERY AND COUNTERFEITING 15 Hrs

Detecting forgery in bank cheques / drafts and educational records (mark lists, certificates), using UV–light, Alloy analysis using AAS to detect counterfeit coins, Checking silverline water mark in currency notes.

Jewellery: detection of gold purity in 22 carat ornaments, detecting gold plated jewels, authenticity of diamonds (natural, synthetic, glassy).

References

1. Lawrence Kobilinsky, Forensic Chemistry Hand book, John Wiley & sons, 2012.
2. S. Bell, Forensic Chemistry, Prentice Hall, 2nd edition, 2012.
3. B. Levine, Principles of Forensic Toxicology, 4th edition, American Association for Clinical Chemistry (AACC) Press, 2013.
4. M. Bogusz, Forensic Science, Elsevier, 2000.
5. B.H. Stuart, Forensic Analytical Techniques, Wiley, 2013.
6. D.G. Toxicology of Drug Abuse, Wiley, 2012.

CHSC–405A CHEMISTRY OF MATERIALS

Unit–1 NANOMATERIALS **15 Hrs**

Classification, types of carbon nano tubes synthesis, functionalisation, characterization and applications, Preparation of nanoscale materials: Precipitation, mechanical milling, colloidal routes, self assembly, Synthesis, Characterization and applications of nanoparticles, Elemental nanoparticles: Pure Gold, Silver and Silicon, Oxide nanoparticles: Silica, Zinc oxide and Alumina.

Unit–2 PREPARATIVE TECHNIQUES **15 Hrs**

Principles of solid state synthesis–ceramic methods, solid solution and compound precursors (nitrates, carbonates and hydroxides) Sol–gel, Spray Pyrolysis, Combustion, Hydrothermal, Electrosynthetic. Amorphous Materials: Crystalline versus amorphous solids, glass formation, Preparation techniques–meltspinning, Sputtering, ion implantation, structural models of amorphous materials. Properties of metallic glasses–mechanical, electronic and magnetic properties.

Unit–3 SUPRAMOLECULAR CHEMISTRY–I **15 Hrs**

Definition of supramolecular chemistry. Nature of binding interactions in supramolecular structures: ion–ion, ion–dipole, dipole–dipole, H–bonding, cation–π, anion–π, π–π, and van der Waals interactions. Synthesis and structure of crown ethers, lariat ethers, podands, cryptands, spherands, calixarenes, cyclodextrins, cyclophanes, cryptophanes, carcerands and hemicarcerands. Host–Guest interactions, pre–organization and complimentarity, lock and key analogy. Binding of cationic, anionic, ion pair and neutral guest molecules. Crystal engineering: role of H–bonding and other weak interactions.

Unit–4 SUPRAMOLECULAR CHEMISTRY–II **15 Hrs**

Self–assembly molecules: design, synthesis and properties of the molecules, self assembling by H–bonding, metal–ligand interactions and other weak interactions, metallomacrocycles, catenanes, rotaxanes, helicates and knots. Molecular devices: molecular electronic devices, molecular wires, molecular rectifiers, molecular switches, molecular logic. Relevance of supramolecular chemistry to mimic biological systems: cyclodextrins as enzyme mimics, ion channel mimics, supramolecular catalysis etc.

References

1. A.R. West, Solid State Chemistry and its Applications, John Wiley & Sons, 1989.
2. S. Mohan, V. Arjunan and Sujin P. Jose, Principles of Materials Science, MJP Publishers, Chennai, 2018.
3. Y. Marcus, Introduction to Liquid State Chemistry, Wiley, 1977.
4. C.A. Croxton, Introduction to Liquid State Physics, Wiley, 1975.

5. C.M. Srivastava and C. Srinivasan, Science of Engineering Materials, Wiley–Eastern Ltd., 1991.
6. Hari Singh Nalva, Encyclopedia of Nanomaterials and Nanotechnology, USA, 2011.
7. T. Pradeep, NANO: The essentials, McGraw Hill, 2008.
8. W.D. Callister, Material Science and Engineering, John Wiley and Sons Inc., 1985.
9. J.M. Lehn, Supramolecular Chemistry–Concepts and Perspectives, Wiley–VCH, 1995.
10. P.D. Beer, P.A. Gale, D.K. Smith, Supramolecular Chemistry, Oxford University Press, 1999.
11. J.W. Steed and J.L. Atwood; Supramolecular Chemistry, Wiley, 2000.
12. B.R Puri, L.R Sharma, M.S Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

CHSC–405B FOOD CHEMISTRY AND TECHNOLOGY

UNIT–1 INTRODUCTION 15 Hrs

Food: source, functions of food–food groups–group guide–basic five food groups, usage of the food guide–food in relation to health–objectives of cooking.

Water: Purification processes–Ion exchangers, reverse osmosis, activated charcoal treatment, Use of chlorination, ozone and UV light disinfection, Specification of drinking water, Water born diseases–microbiological examination, Sources and detection.

Milk: Composition and effectiveness as a diet, Fat content in milk, whole and skimmed. Effect of cooking and heat processing of milk–pasteurization, Preservation of milk, Deep freeze preservation, dairy products–cheese, butter, ghee and kova, Spray drying technique–milk powder, infant food preparation, Lactose intolerance Milk substitutes–vegetable milk, Toned milk.

UNIT–2 FOODS AND FOOD ADDITIVES 15 Hrs

Food additives: Artificial sweeteners–saccharin, cyclomate, asparatame–food flavours–esters, aldehydes and heterocyclic compounds, Antioxidants, Food colours–changes in cooking, Restricted use, Spurious colours, Emulsifying agents, preservatives – leavening agents, Baking powder–Yeast, Taste enhancers–MSG–vinegar.

Modern food: Mushroom cultivation and types, spirulina composition, Snack foods, Production of bread, bun and biscuits, Raw materials, methods and machinery required, Candy manufacturing, Caramellisation, Fast foods, Instant foods, Dehydrated foods, Oleoresin of spices, Condiments.

Beverages: Soft drinks–composition of soft drinks, soda, fruit juices and alcoholic beverages (Types and content of alcohol), Carbonation, Cirrhosis of liver, Social problems. Excessive use leading to urinary bladder stones, Preservation of tetrapak, Nitrogen preservation and packing of fruit juices, coconut water.

UNIT–3 NUTRITION AND BALANCED DIET 15 Hrs

Nutrition: Calorific value of food stuff–RQ of food (Respiratory quotient of food)–basal metabolic rate–factors influencing BMR, specific dynamic action (SDA) of food.

Thermogenic effect: Energy requirements of individuals–diet and its components–the protein requirements–biological value of proteins, supplementary value of proteins, diseases associated with protein malnutrition, nutritional value of carbohydrates–fibers in the diet, dietary sugars–nutritional aspects of lipids.

UNIT–4 FOOD ADULTERATION AND HYGIENE 15 Hrs

Adulterants: Common adulterants in different foods–milk and milk products, vegetable oils and fats, spices and condiments, cereal, pulses, sweetening agents and beverages, Contamination with toxic chemicals–pesticides and insecticides, principles involved in the analysis of detection and prevention of food adulteration.

Microbial Growth: Growth curve of bacteria, Effect of environmental factors on growth of microorganisms, pH, water activity, oxygen availability temperature–beneficial effect of micro organisms, Food borne illness–bacteria, virus, moulds and parasites (any two illness each).

Food Preservation and processing: Food deterioration, methods of preservation and processing.

Quality Control: Specifications and standards: Portable Format for Analytics (PFA), Fruit Product Order (FPO), Food and Drug Administration (FDA), drug license, World Health Organisation (WHO) standards, Indian Standards Institution (ISI) specifications, packing and label requirements, essential commodities act, consumer protection act, Agricultural Marketing (AGMARK).

References

1. M. Swaminathan, Advanced Text Book on food and Nutrition, Vol. I and II, Priting and Publishing Co., Bangalore, 1993.
2. Norman N. Potter, Food Science, CBS Publishers and distributors, New Delhi, 1994.
3. Lillian Hoagoland Meyer, Food Chemistry, CBS Publishers and distributors, New Delhi, 1994.
4. Owen R. Fennema, Food Chemistry, Marcel Decker Inc., New York, 1996.
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6. B. Siva Sankar, Food Processing and Preservations, Prentice–Hall of India Pvt. Ltd., New Delhi, 2002.
7. S. Ramakrishnan, K.G. Prasannam and R. Rajan, Principles, Text book of Medical Biochemistry, 3rd ,edition, Orient Longman Ltd., 2001.
8. N. Shakuntala Manay and M. Shadaksharaswamy, Foods: Facts and Principles, 2nd edition, New Age International Pvt. Ltd. Publishers, 2002.

CHHP–406 Practical–IV INSTRUMENTAL EXPERIMENTS

1. POLARIMETRY

Determination of optical rotation of a chiral compounds and determination of concentration.

2. WATER ANALYSIS

a) Determination of pH of a sample of water.
b) Determination of Salinity of a sample of water.
c) Determination of Dissolved Oxygen present in a sample of water.
d) Determination of Total Dissolved Salts (TDS) present in a sample of water.
e) Estimation of nitrogen present in the sample water by Kjeldahl's method & spectrophotometry.

3. SOIL ANALYSIS

Estimation of nitrogen present in the sample soil by Kjeldahl's method & spectrophotometry

4. ADVANCED LEVEL EXPERIMENTS

a) Determination of CMC of the surfactants by conductometric method.
b) Preparation of complex and determination of CFSE, Nephelauxetic effect, Rach parameter B, and the extent of covalent character of the bond in the complex.
c) Kinetic study of the saponification an ester by conductometric method.
d) Composition and stability of complexes by mole ratio method.
e) Composition and stability of complexes by Continuous variation method.
f) Composition and stability of complexes by Slope ratio method.

References

1. D.P. Shoemaker, C.W. Garland and L.W. Niber, Experimental Physical Chemistry, McGraw–Hill, Boston, 2003.
2. B.P. Levett, Findlay's Practical Physical Chemistry, 9th edition, Longman, 1973.
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CHSC–206A BASIC CHEMISTRY–I (for Botany and Zoology)

Unit–I STEREOCHEMISTRY **15 Hrs**

Geometrical isomerism with reference to Maleic acid and Fumaric acids, Optical isomerism–Cause of optical activity–Lactic acid and Tartaric acids, Conformation of ethane, propane and *n*–butane.

Unit–II ISOTOPES **15 Hrs**

Definition, Separation, Application of isotopes in analytical chemistry, medicines, plant and animal studies–Radio carbon dating.

Unit–III BOND PROPERTIES **15 Hrs**

Bond length, bond order and bond strength, Hybridizations and geometry of simple molecules, Concept of resonance–Resonance energy, Resonance of mono substituted benzene, phenol, benzaldehyde, aniline and nitrobenzene.

Unit–IV VITAMINS AND NATURAL PRODUCTS **15 Hrs**

Sources and applications of water soluble vitamins–B_1, B_2, B_{12} and C. Fat soluble vitamins–A, D, E and K. Natural Products–definition, sources and applications of the following compounds: (1) Alkaloids–Nicotine and Quinoline; (2) Terpenoids–Citral and Menthol; (3) Anthrocynins–Cyanin

References

1. R.T. Morrison & R.N. Boyd, Organic Chemistry, 6th edition, Pearson Education, 2004.
2. B.R Puri, L.R Sharma, M.S Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.
3. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 5th edition, John Wiley.
4. P.C. Rakshit, Physical Chemistry, Sarat Book Distributors, 2013.
5. B.R. Puri, L.R Sharma, K.C.Kalia, Principles of Inorganic Chemistry, 33rd edition, Vishal Publishing Co., 2017.
6. Arun Bahl, B.S. Bahl, A Textbook of Organic Chemistry, S. Chand & Company, 2016.
7. J.D. Lee, Concise Inorganic Chemistry, Fifth edition, Oxford, 2008.

CHSC–206B BASIC CHEMISTRY–II (for Physics)

Unit–I INTERMOLECULAR FORCES 15 Hrs

Vanderwaal's and London forces, Liquid state–theory and properties of liquid state, Liquid crystals–formation and applications, Solid state–forces in solids–covalent, ionic, metallic and Vanderwaal's. Amorphous and Crystalline solids, Crystal lattices and unit cells, Number of atoms in a unit cell. Packing efficiency in hexagonal close packed (HCP) and cubic close packed (CCP), body centered cubic (BCC) and simple cubic (SC) lattice, Calculation involving unit cell dimension, Lattice energy, Evaluation by Born–Haber cycle.

Unit–II CHEMICAL KINETICS AND PHOTOCHEMISTRY 15 Hrs

Order and molecularity of reaction, Kinetics of first, second and zero order reactions, Determination of order of reaction–Activation energy–Effect of temperature on reaction rates.

Law of photochemistry, Quantum yields, Kinetics of photochemical reaction of $H_2 + Br_2 \leftrightarrow 2HBr$, Flourescence and Phosphorescence.

Unit–III SOLID STATE CHEMISTRY 15 Hrs

Imperfections in solids–Frenkel and Schottky defects, Non–stoichiometry defects, line defects, and plane defects, Thermal properties–Heat capacities of solids, Dulong–Petit law, Thermal conductivity of insulators and thermal expansion coefficient, Electrical conductivity–Origin of band gap, Fermi energy, Density of states, Thermal conductivity of metals, semiconductors and superconductivity.

Unit–IV CHEMICAL THERMODYNAMICS 15 Hrs

Free energy change and equilibria, Calculation of ΔH, ΔS, ΔG and K, Effect of temperature and pressure dependence for various types of chemical reactions, Partial molar quantities, concept of activity, dependence of activity and activity coefficient on pressure and temperature, fugacity and its dependence on pressure and temperature, fugacity in a mixture.

References

1. P.W. Atkins and Julio De Paula, Physical Chemistry, 8th edition, Oxford University Press, 2006.
2. T. Engel and P. Reid, Physical Chemistry, Pearson Education, 2006.
3. K.J. Laidler, Chemical kinetics, 3rd edition, Harper International, 1987.
4. H.V. Keer, Solid State Chemistry, Wiley Eastern, 1993.
5. B.R Puri, L.R Sharma, M.S Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

CHSC–206C CHEMISTRY IN LIFE (COMMON FOR ANY BRANCH)

Unit–I WATER **15 Hrs**

Basics of chemistry–Elements, compounds, atoms, molecules, ions, physical and chemical change, chemical equations, structures and branches of chemistry.

Water: Specifications for water, analysis of water–alkalinity, hardness and its determination (EDTA method only). Water for domestic use, Water softening processes–Lime–Soda process, Ion exchange method, and boiler feed water.

Unit–II FOOD **15 Hrs**

Chemical composition–Carbohydrates: Composition, classification, food sources, functions and storage in body. Lipids: Composition, classification, saturated and unsaturated fatty acids, food sources and functions. Proteins: Composition, sources, essential and non– essential amino acids, denaturation and functions. **Minerals**–functions, sources, bio–availability and deficiency of following minerals–calcium, iron, fluorine, sodium, potassium. **Vitamins**–classification, units of measurement sources, functions and deficiency of fat soluble and water soluble vitamins. **Enzymes**–digestive enzymes and its role

Unit–III INDUSTRIAL CHEMISTRY **15 Hrs**

Energy: Fuels– Classification, combustion and chemical principles involved in it, Production of electricity using alternate source of energy–solar, nuclear and hydel. **Corrosion:** Types of corrosion (dry, wet).

Polymerization. Types of Polymerization–Addition and Condensation Polymerizations. Plastics –Thermosetting and Thermoplastics–composition and uses of the following: Polyethylene, PVC, Teflon, Bakelite, Polyester, **Rubber–**Natural and synthetic Rubber . **Cement:** Chemical Constituents and Composition of Cement–Setting and Hardening.

Unit–IV ENVIRONMENTAL POLLUTION AND CONTROL **15 Hrs**

Air Pollution: Types of pollutants, source effects, sink and control of primary pollutants–CO, NO_X, HC, SO_X and particulates, effects of pollutants on man and environment–photochemical smog and acid rain. **Water Pollution:** Classification of pollutants, their sources, waste water treatment–domestic and industrial. **Soil Pollution:** Composition of soil, classification and effects of soil pollutants and their control. **Solid Waste Pollution:** Classification, waste treatment & Disposal methods (Composting, sanitary land filling, thermal processes, recycling and reuse). **Hazardous Wastes:** Classification–radioactive, biomedical and chemical.

References

1. P.C. Jain & M. Jain, Text Book of Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 2015.
2. C.P. Murthy, C.V. Agarwal and A. Naidu, Chemistry of Engineering Materials, BS Publications, Hyderabad, 2006.
3. Y.H. Hui, Food Chemistry: Principles and Applications, 2nd edition, Science Technology System, Sacramento, CA, 2007.
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13. Shashi Chawla, A Text book of Engineering Chemistry, Dhanpat Rai Publishing Company, 2003.
14. S.K. Bhasin and Sudha Rani, Laboratory Manual on Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 2003.
15. R. Gopalan, D. Venkappaya and S. Nagarajan, Text Book of Engineering Chemistry, Vikas Publishing House, New Delhi, 2013.
16. Gurdeep R. Chatwal, Synthetic drugs, Himalaya Publishing House, Mumbai, 2013.

CBCS SYLLABUS FOR M. PHIL CHEMISTRY

SEMESTER–I
MCHH–101 RESEARCH METHODOLOGY

UNIT–I SELECTION OF RESEARCH PROBLEMS AND SURVEY OF SCIENTIFIC LITERATURE 15 Hrs

Primary sources of journal and patents–Secondary sources–Abstracts–Beilstein–Compendia–Reviews–General treatises–Monograph and treatises on specific areas–Literature searching–Information about a specific compound–Science Citation Index

UNIT–II THESIS AND PAPER WRITTING 15 Hrs

Conventions in writing a thesis–General format–Page and chapter format–Use of quotations and footnotes–Preparation of tables and figures–References–Appendices–Revising, editing and evaluating the final material–Proof reading–meanings and example of commonly used abbreviation.

UNIT–III SEPARATION AND PURIFICATION TECHNIQUES 15 Hrs

Classical criteria for determining the purity: crystallization, distillation, melting point, elemental composition. Solvent extraction–Chromatographic techniques: Open column, planar, HPLC, GLC, ion–exchange and size exclusion. Coupled/Hyphenated techniques: GC/MS, LC/MS, LC/PAD, LC/NMR.

UNIT–IV DATA ANALYSIS 15 Hrs

Precision and accuracy–Reliability–Determinate and random errors–Distribution of random errors–Normal distribution curve–Statistical treatment of finite samples–T test and F test–criteria for rejection of an observation–The Q test–Significant figures and computation rules–Data plotting–Least square analysis–Significance of correlation coefficient.

References

1. G. W. Snedecor and W. G. Cochran, Statistical Methods, 6th edition, Oxford & IBH Publications, New Delhi, 1967.
2. K. Eckschlager, Errors, Measurements & Results in Chemical Analysis, Van Nostrand Reinhold Company, London, England, 1969.
3. Anderson, Thesis & Assignment Writing, Prentice Hall, New Delhi, 1970.
4. J. Topping, Errors of Observation and their Treatment.
5. R. Gopalan, Thesis Writing, Vijay Nicole Imprints Private Limited, Chennai, 2005.

MCHH–102 SELECTED TOPICS IN CHEMISTRY

UNIT–I RECENT DEVELOPMENTS IN SPECTROSCOPY 15 Hrs

Simplification of complex spectra, spin decoupling or double resonance–INDOR, Introduction to pulsed NMR technique–High Field Spectrometer–FTNMR–Advantages of FT–NMR; Spin Echos–NOE–SEPT–DEPT. Introduction to 2D NMR ^{1}H–^{1}H COSY, $^{1}H-^{13}C$ COSY, HMQC, HMBC, NOESY. Modern Techniques including FI, CI, SI and FAB Techniques. MIKES, Problems using UV–Visible, IR, Mass (ElMS), ^{1}H and ^{13}C NMR.

UNIT–II REAGENTS IN ORGANIC SYNTHESIS 15 Hrs

1. Pyridinium chlorochromate
2. Dicyclohexyl carbodiimide
3. Trimethyl silyl azide, Trimethyl silyl chloride
4. Optically active reducing agent (alpine borane) (Di isocamphinyl borane)
5. Tri–*n*–butyl tin hydride
6. Diethyl azodicarboxylate

UNIT–III MOLECULAR RECOGNITION IN ORGANIC SYNTHESIS 15 Hrs

Designed Host–Guest relationship, Biomimetic Control of Chemical Selectivity, Molecular recognition in Organic synthesis

UNIT–IV GREEN CHEMISTRY 15 Hrs

Green Chemistry–Definition, principles and evolution of green chemistry. Heterogeneous reaction for green chemistry, Alternative solvents: ionic liquids, super critical fluid extraction, organic synthesis using water resistant Lewis acids. Solvent free reaction: Microwave assisted organic synthesis–the reaction vessel, medium, advantages, limitations and application. The use of ultrasound in organic synthesis: Introduction, instrumentation, types of sonochemical reactions, esterification, substitution, oxidation, reduction.

References

1. R.K. Mackie and D.M. Smith, Guide book to Organic Synthesis, ELBS, 1982.
2. S. Waver, Organic Synthesis: The disconnection Approach, John Wiley & Sons, 1982.
3. W. Carruthers, I. Coldham, Modern Methods of Organic Synthesis, 4th edition, Cambridge University Press, 2004.
4. P.T. Ananstas, J.C. Warner, Green chemistry–Theory and Practice, Oxford University Press, New York, 2000.
5. R. Sanghi, M.M. Srivastava Narosa, Green Chemistry–Environment Friendly Alternatives, Publishing House, Chennai, 2003.
6. V.K. Ahluwalia, R. Agarval, Organic Synthesis–Special Tehniques, Narosa

Publishing House, Chennai, 2001.
7. V.K. Ahuluwalia, M. Kidwai, New Trends in Green Chemistry, Anamaya Publishers, 2007 .
8. Willium Kemp, Organic Spectroscopy, 3rd edition, Macmillan, 1994.
9. R.M. Silverstein and F.X. Webster Spectrometric Identification of Organic Compounds, John Wiley, 1997.
10. W. Kemp, Introduction to Multinuclear NMR, Macmillan, London, 1986.
11. D.H. Williams and Jan Fleming, Spectroscopic Methods in Organic Chemistry, Tala-McGraw Hill, 1998.
12. Donald L. Pavia, Gary M. Lampman, George S. Kriz, Introduction to Spectroscopy, Brooks Cole, 2008.

For M.Phil Degree:

Total marks for theory Paper–I and Paper–II = 100 Marks (CIA = 40* marks (Test = 15 (Best two out of Three) + Model Exam = 15 + Seminar = 10) and End Semester Examination = 60 marks).

Question Paper Pattern (Paper–I & Paper–II):

Part–A (2 × 5 = 10 marks) Answer all the questions
5 Two mark questions – at least 1 question from each unit.

Part–B (5 × 4 = 20 marks) Answer all the questions
4 Five mark questions each with internal choice (one question from each unit).

Part–C (10 × 3 = 30 marks) Answer any three questions
5 Ten mark questions – at least 1 question from each unit (maximum 2 subdivisions (5 + 5) in a question).

Total marks for theory Paper–III (Setting by the Guide in the field of Research) = 100 Marks (No CIA and End Semester Examination = 100 marks).

Question Paper Pattern (Paper–III):

Part–A (2 × 10 = 20 marks) Answer all the questions
10 Two mark questions – minimum 2 questions must be from each unit.

Part–B (5 × 4 = 20 marks) Answer all the questions
4 Five mark questions each with internal choice (one question from each unit).

Part–C (15 × 4 = 60 marks) Answer any four questions
6 Fifteen mark questions – 1 question must be from each unit (maximum 2 subdivisions (10 + 5) in a question).