GOBI ARTS & SCIENCE COLLEGE (AUTONOMOUS) : GOBICHETTIPALAYAM

SCHEME OF EXAMINATIONS - M.Sc. CHEMISTRY (17 BATCH)

No.	Code	Subject Title	Hrs	CIA	EOSE	Total	Credit
		SEMESTER : I					
1	15P3CH01	INORGANIC CHEMISTRY-I	3	30	70	100	4.0
2	15P3CH02	ORGANIC CHEMISTRY-I	3	30	70	100	4.0
3	15P3CH03	PHYSICAL CHEMISTRY-I	3	30	70	100	4.0
4	16P3CH04	ELECTIVE – I: MOLECULAR SPECTROSCOPY	3	30	70	100	4.0
		SEMESTER : II					
5	15P3CH05	INORGANIC CHEMISTRY-II	3	30	70	100	4.0
6	15P3CH06	ORGANIC CHEMISTRY-II	3	30	70	100	4.0
7	15P3CH07	PHYSICAL CHEMISTRY-II	3	30	70	100	4.0
8	16P3CH08	ELECTIVE – II: PHYSICAL METHODS IN CHEMISTRY - I	3	30	70	100	4.0
9	15P3CHP1	PRACTICAL-I: INORGANIC CHEMISTRY-I	6	30	70	100	3.0
10	15P3CHP2	PRACTICAL–II: ORGANIC CHEMISTRY-I	6	30	70	100	3.0
11	16P3CHP3	PRACTICAL–III: PHYSICAL CHEMISTRY-I	6	30	70	100	3.0
		SEMESTER : III					
12	17P3CH09	INORGANIC CHEMISTRY-III COORDINATION CHEMISTRY	3	30	70	100	4.0
13	17P3CH10	ORGANIC CHEMISTRY-III	3	30	70	100	4.0
14	15P3CH11	PHYSICAL CHEMISTRY-III	3	30	70	100	4.0
15		SUPPORTIVE PAPER	3	30	70	100	4.0
		SEMESTER : IV					
16	17P3CH12	INORGANIC CHEMISTRY-IV ORGANO METALLIC AND BIO INORGANIC CHEMISTRY	3	30	70	100	4.0
17	17P3CH13	ORGANIC CHEMISTRY-IV	3	30	70	100	4.0
18	16P3CH14	ELECTIVE – III: ANALYTICAL CHEMISTRY	3	30	70	100	4.0
19	15P3CHP4	PRACTICAL-IV:INORGANIC CHEMISTRY-II	6	30	70	100	4.0
20	15P3CHP5	PRACTICAL–V: ORGANIC CHEMISTRY-II	6	30	70	100	4.0
21	16P3CHP6	PRACTICAL–VI: PHYSICAL CHEMISTRY-II	6	30	70	100	5.0
22	15P3CHV1	PROJECT WORK AND VIVA VOCE		30	70	100	8.0
						TOTAL CREDITS :	90

SEMESTER – I

INORGANIC CHEMISTRY-I

Objective

1. To understand the basic concepts of Inorganic chemistry.
2. To learn about the structure and bonding of the molecule.
3. To learn the basics of nuclear chemistry and different types of nuclear reactions

Unit-I (15 hours)

MAIN GROUP CHEMISTRY: Chemistry of boron - boranes, higher boranes, carboranes, borazines and boron nitrides. Chemistry of silicon- silanes higher silanes, multiple bonded systems, disilanes, silicon nitrides, siloxanes and silicates, S-N compounds - S_4N_4, $(SN)_x$.

Unit - II (15 hours)

STRUCTURE AND BONDING: Hard and soft acids and bases- classification, Acid-base strength, hardness, symbiosis, Theoretical basis of hardness and softness, application of HSAB.

RINGS: Craig and Peddok model. Dewar model.

Poly Acids:Isopolyacid of V, Cr, Mo and W. Heteropolyacidsof Mo and W.

Unit - III (15 hours)

NON-AQUEOUS SOLVENTS: Classification of solvents-Properties of ionizing solvents-a general study of the typical reactions in liquid ammonia, SO_2, anhydrous hydrogen fluoride, H_2S and HCN-A comparative study of organophosphorous compounds, alkyl lithium compounds.

IONIC MODEL: Lattice energy – BornLande equation- Kapustinski equation - High Tc superconductors - Solid state reactions-Types and examples.

Unit-IV (15 hours)

NUCLEAR CHEMISTRY: The nucleus-subatomic particles and their properties-binding energy - n/p ratio in stable and metastable nuclei-Different types of nuclear forces-Liquid drop model and shell model, Modes of radioactive decay-Theory of alpha decay, beta decay and gamma radiation, Orbital electron capture, nuclear isomerism-internal conversion.Cloud chamber, bubble chamber, Proportional counter,G.M counter and Cherenkov counter.

Particle Accelerators: Linear accelerator- cyclotron, synchrotron, betatron and bevatron.

Unit-V (15 hours)

Nuclear Reactions: Q-value, columbic barrier- nuclear cross section-different types of nuclear reactions-projectile capture-particle emission, spallation, fission and fusion-product distributions - Theories of fission, use of fission products, fissile and fertile isotopes - U-238, U-235, PU-239, Th-232 -stellar energy-synthesis of new elements.

RADIO-ISOTOPES: Applications-isotopes as tracers - neutron activation analysis and isotopic dilution analysis - uses in structure and mechanistic studies - Carbon dating – Hot atom chemistry - Disposal of nuclear waste.

TEXT BOOK:

1. F.A Cotton & Wilkinson, Advanced Chemistry

2. Emelius and Sharpe, Modern Aspects of Inorganic Chemistry.

3. S. Glasstone, Source Book on Atomic Energy.

4. J.D. Lee, Concise Inorganic Chemistry.

5. S.F.A. Kettle, Physical Inorganic Chemistry, Oxford University

ORGANIC CHEMISTRY – I

Objective

1. To learn about the basic concepts of aromaticity.
2. To know the basic concepts of reaction mechanism of organic compounds.
3. To understand the concepts of substitution reactions of aliphatic and aromatic compounds.

Unit - I (15 hours)

Aromaticity - Benzenoid and non benzenoid aromatics- ferrocene, azulene and annulenes. Alternant and non-alternant hydrocarbons- homoaromaticity- antiaromaticity.Kinetic and non-kinetic methods of determining reaction mechanism- isotopic effect, study of intermediates, isotopic labelling and cross over experiments.Hammond's postulates.Linear free energy relationship- Hammet equation.

Unit - II (15 hours)

Arenium ion mechanism orientation and reactivity of mono and disubstituted benzenes. Aromatic electrophilic substitution reactions:Gattermannn, Gattermann-Koch, Reimer-Tiemann, Kolbe, BischlerNapieralski, Hoffmann Maritus and Jacobsons reactions. Friedal Crafts alkylation and acylation. Aromatic nucleophilic substitution reactions, Benzyne mechanism, Intermediate complex mechanism and SNAr mechanism structure reactivity relationship Ziegler alkylation and Chichibabinrecation

Unit - III (15 hours)

Aliphatic nucleophilic substitution reactions – S_N1, S_N2, S_Ni, S_N1',S_N2' and S_Ni' mechanisms, substitution at vinyl carbon, stereochemistry of nucleophilic substitution reaction, effect of substrate structure, solvent, leaving group andnucleophilicity, ambident nucleophiles and substrates, neighbouring group participation, Aliphatic electrophilic substitution reactions, SE_1,SE_2 and SEi mechanisms, structure reactivity relationship. Friedal Crafts acylation at olefinic carbon – Stork – enamine reaction.

Unit - IV (15 hours)

Electrophilic nucleophilic and free radical addition reaction to double and triple bonds , hydration, hydroboration, Michael addition, epoxidation and hydroxylation, Addition reactions to carbonyl compounds- Mannich reaction- MeerweinPonndorff- Verely reduction, addition of Grignard reagents to aldehydes and ketones,Claisen, Diecmann, Stobbe, Knoevenagel, Darzen, Wittig, Thorpe and Benzoin reactions.

Unit – V (15 hours)

Elimination reactions: E_1, E_2, E_i, $E1_CB$ mechanisms, stereochemistry of elimination reactions, effect of substrate structure, attacking base, leaving group, medium and eliminations Vs substitution. Typical elimination reactions, Chugaev reaction, Hoffmann exhaustive methylation, Cope elimination and dehydration of alcohols.Carbens and nitrenes –Structure, generation and reactions.

References

1. I.L. Finar Organic chemistry, Vol I, ELBS, Edn V
2. Jerry March, Advanced organic chemistry, (Reaction Mechanism and structure), John Wiley & Sons.
3. R.L. Morrision and R.N. Boyd Organic Chemistry, Prentice Hall of India Pvt. Ltd., Edn. VI(1992)
4. Badger, Aromaticity and Aromatic Character, Cambridge university Press
5. Raj K. Bansal Organic Chemistry Reaction Mechanisms in organic chemistry, Harper & Row Publishers
6. Jagdamba Singh and L.D.S. Yadav, Advanced Organic Chemistry, PragatiPrakashan, 2011
7. Jagdamba Singh and L.D.S. Yadav, Organic Synthesis, PragatiPrakashan, 2011
8. Organic Chemistry, Singh and Mukerjee.

PHYSICAL CHEMISTRY –I

Objective

1. To acquire about the basic knowledge of quantum mechanics and its applications. distinguish

2. To get the basic concepts of group theory and chemical kinetics.

3. To learn about the enzyme catalysis and different isotherm models.

UNIT – I Quantum Mechanics (15 hours)

Functions and operators- Eigen functions, Eigen values-Operators: linear, differential, and Hermitian and Hamiltonian operators - Failure of Classical Mechanics and the need for QM- Postulates of QM- The time-dependent and time-independent Schrodinger wave equations-Application to simple systems.-Solution of Schrodinger wave equation for a free particle, particle in one dimensional box, particle in 3D box, separation of variables, degeneracy. One dimensional Harmonic oscillator-Complete solution. Hermite polynomials, recursion formula, feature of the wave functions. The Hydrogen atom: Solution to Hydrogen wave equation. Stern-Gerlach experiment. The postulate of spin. Spin orbital.

Unit II Quantum Mechanics II (15 hours)

Born Oppenheimer approximation- Approximate methods in quantum mechanics – need for the approximation methods – perturbation and variation methods applicable to H_2 molecule in the ground and excited states – He atom in the ground state, He_2^+ in the ground and excited state.

Quantum mechanical treatment of MO theory. LCAO – MO methods –HMO treatment of simple and conjugated π- electron systems – ethylene system – delocalization energy – construction and use of hybrid orbitals – directional character – determination of bond angles.

SALC procedure(Symmetry Adapted Linear Combination) –Simple Huckel Theory to linear conjucated systems-Applications of SALC procedure-Butadiene-Benzene.

UNIT - III Group Theory and its Applications (15 hours)

Symmetry elements and symmetry operations. Matrix representation of symmetry operations. Character of a matrix. Point groups. Multiplication of operations. Group multiplication table. Similarity transformation and classification of symmetry operation, Matrix representation of point group. Reducible and Irreducible representations. The Great Orthogonality theorem. Rules derived from GOT. Character table of C_{2v}, C_{3v} and C_{2h} point groups only. Molecular symmetry and optical activity. Symmetry selection rules of infra-red and Raman spectra - application of group theory for the electronic spectra of ethylene and formaldehyde

Unit - IV Chemical Thermodynamics I (15 hours)

III Law of Thermodynamics & Entropy Need for III Law – Richard's law -Nernst Heat Theorem– Plank's statement –Gibbs free energy – Helmholtz free energy – Gibbs Helmholtz equation - Thermodynamic Quantities at Absolute Zero – Apparent Exceptions – Helium at Low Temperature – Negative Absolute Temperature

Entropy of Gases – Entropy at Absolute Zero – Entropy and Probability (Boltzmann Expression) – Planck Equation – Significance of Thermodynamic Probability – Entropy of Expansion of Ideal Gas - Entropy change accompanying change of phase – Clausius - Clapeyron equation – applications of Clausius Clapeyron equation.

Unit - V Chemical Thermodynamics II (15 hours)

Partial molar properties, Chemical potential Partial molar volume and Partial molar heat content - Their significance and determination. Duhem- Margules equation, Konowaloff's law, Excess thermodynamic functions.

The concept of Fugacity and Activity: definition of fugacity - determination of fugacity - variation of fugacity with temperature and pressure Fugacity of liquids and solids. Fugacity of mixtures of gases. Lewis Randall rule. Activity and Activity coefficients. Determination of activity and activity coefficients –vapour pressure method , solubility method, freezing point method, and emf method.

REFERENCES

1. S. Glasstone, Thermodynamics for Chemists;
2. Kuriakose and Rajaram Thermodynamics;
3. L. Pauling, E.B. Wilson, Introduction to Quantum Mechanics with Applications to Chemistry, McGraw Hill Book Company, Inc., New York, (1935).
4. Ira. N. Levine, Quantum Chemistry, Prentice Hall, New Jersey, V Edn., (2000).
5. A.K. Chandra, Introduction to Quantum Chemistry, TMH, Chennai, (1988).
6. D.A. McQuarie, Quantum Chemistry, Oxford University Press, Calcutta, (1982).
7. W.J. Moore, Physical Chemistry (1962).
8. P.W. Atkins, J. De. Paula, Atkin's Physical Chemistry, 8th Edn., Oxford University Press, Oxford, (2006).
9. R.K. Prasad, Quantum Chemistry, Wiley Eastern Ltd., Chennai, (1992).
10. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, 41st Edn., (2006).
11. Ramakrishnan, Gobinathan, Group Theory in Chemistry.
12. K.V. Raman, Group Theory
13. Carter, Molecular Symmetry and Group Theory

Elective: I MOLECULAR SPECTROSCOPY

Objective

1. To learn about the various spectroscopic techniques.

2. To understand the basic knowledge of spectroscopic techniques.
3. To learn about the instrumentation and applications of different spectroscopic techniques.

Unit - I (15 hours)

Ultraviolet and Visible Spectroscopy-Various electronic transitions (185-800 nm), Laws of photochemistry, theory of Ultraviolet and visible spectroscopy, Selection rule – Frank – Condon principle. Origin of different bands (R, K & B). Absorption intensity shifts. effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser-Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heterocyclic compounds. Steric effect in biphenyls.Instrumentation.

Unit - II (15 hours)

IR Spectroscopy – Theory – Molecular vibrations – Calculation of vibrational frequency. Number of fundamental vibrations – Selection rules, force constant, finger print region – identification of functional groups –factors influencing vibrational frequencies of a molecule Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids,anhydrides, lactones, lalctams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance. FT IR. IR of gaseous, solids andpolymeric materials.application of IR to simple organic molecules. Fourier transformations in IR spectroscopy.
The Raman spectroscopy – Fundamentals- theory-Instrumentation- comparison between IR and Raman spectra.

Unit - III (15 hours)

Mass spectrometry, Principle, working of mass spectrometer (double beam). – sample inlet system, ion source, mass analyser and ion detectors. Determination of molecular formula – nitrogen rule – isotopic abundance – metastable ions and peaks – the molecular ion peak, base peak, odd even electron ions. Retro Diels – Alder rearrangement – Mclafferty rearrangement ionization techniques, isotope abundance, molecular ion, fragmentation processes of organic moleculesragmentation associated with functional groups – aliphatic compounds, aldehydes – ketones – carboxylic compounds ester – amides – alcohols and halides., deduction of structure through mass spectral fragmentation, high resolution MS, soft ionization methods, ESI-MS and MALDI-MS, illustrative examples from macromolecules and supramolecules,studies of inorganic/coordination and organometallic representative compounds.
Mossebauer spectroscopy - Principle, Mossebauer effect, Instrumentation. Isomer shift – Quadrupole interactions – nuclear Zeeman splitting and applications-interpretation of spectra.

Unit - IV (15 hours)

Electron Spin Resonance Spectroscopy(ESR):
Basic principle: zero field splitting, factors affecting the ‘g’ value. Isotropic and anisotropic hyperfine coupling constants, Zero field splitting – Krammer’s degeneracy spin Hamiltonian, spin densities, Measurement techniques, ESR instrumentation - application to structure elucidation. Electron paramagnetic resonance (EPR) spectroscopy of inorganic compounds with unpaired electrons - determination of electronic structure, Zeeman splitting, g-values, hyperfine and super hyperfine coupling constants, practical considerations of measurements, and instrumentation.
NQR :Introduction-theory-EFG- QCC-Spilliting in NQR-applications of NQR

Unit - V (15 hours)

NMR spectroscopy – magnetic properties of nuclei – theory of NMR – instrumentation - FT NMR, chemical shift – factors affecting chemical shifts, chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines,amides & mercapto), chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), virtual coupling. chemical equivalent and spin – spin coupling – shielding and deshielding mechanisms – chemical exchange – applications of NMR to simple organic molecules, Nuclear magnetic double resonance technique – NDMR and INDOR. Two dimension NMR spectroscopy – COSY, NOESY, DEPT, INEPT, APT and INADEQUATE techniques.

^{13}C NMR, introduction to FT technique, relaxation phenomena, NOE effects, ^{1}H and ^{13}C chemical shifts to structure correlations. Study of dynamic processes by VT NMR, restricted rotation (DMF, DMA, biphenyls, annulenes), cyclohexane ring inversion, degenerate rearrangements (bullvalene and related systems).

Recent advances in NMR techniques: Introduction -basic principle of 31P-NMR and 19F-NMR

References

1. N. Banwell – Molecular Spectroscopy.
2. Donald L. Pavia, Gary M. Lampman and George S. Kriz, Jr – Introduction to Spectroscopy.
3. R.M. Silverstein and G.C. Basler – Spectroscopic Identification of organic compounds.
4. William Kemp – Organic Spectroscopy.
5. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Horwood.
6. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpeuch and G.J. Martin,Heyden.
7. Introduction to NMR Spectyroscopy, R.J. Abraham, J. Fisher and P. Loftus,Wiley.
8. Application of Spectroscopy of Organic Compounds, J.R. dyer, Prentice Hall.
9. Spectroscopic Methods in Organic Chemistry, D.H. Williams,I.Fleming, Tata McGraw-Hill.

SEMESTER - II

INORGANIC CHEMISTRY-II

(SOLID STATE & NANOCHEMISTRY)

Objective

1. To develop the basic concepts of solid state and Nano chemistry.

2. To understand the different studies used in solid state chemistry.

3. To learn about the synthesis of Nano materials.

Unit-I (15 hours)

Fundamentals - Types of solids-close packing of atoms and ions-bcc, fcc and hcp voids-Goldschmidt radius ratio-derivation-its influence on structures-structure of rock salt - CsClWurtzite - ZnS-TiO_2-fluroite-antifluroite-Diamond and Graphite-Spinel-normal and inverse spinel and Perovskite-lattice energy of ionic crystals-Mandelung constant-Born-Habber cycle and its applications.

Unit - II (15 hours)

Theories of Solid - Band theory of solid, Free electron theory, MO theory of solid –dislocation of solid - Schottky and Frenkel defect - Plane defect, Line defect, Non stoichiometric compounds, Electrical property - Energy bands, insulators, Semiconductors and conductors-Super conductors, Dielectric properties-piezo electricity, Ferro electricity, conductivity of pure solids-Super conductivity - occurrence BCS theory, high temp super conductor-(Introduction to nanoparticle-metal nanoparticle-particle size determination.)

Unit-III (15 hours)

Diffraction Studies : Crystallographic point group-Space groups, Screw axis and glide plane-seven crystal systems and Bravais lattice-Miller indices -interplanar distance in orthogonal crystal system-X-ray diffraction studies-power and rotating crystal methods-Systematic absence and lattice types-data analysis for cubic system-electro diffraction by gases-Principles and measurement – determination of structure - Comparison between electron, neutron and X-ray diffractions, Bragg's spectrophotometer.

Unit-IV (15 hours)

Nano science: Introduction-definition-types-quantum dots-wires and wells, nano rods, fullerenes and carbon nanotubes -nanowires and crystals, nano composites and clusters-properties of nano materials – Plasmon resonance.

Preparation of nano structured materials-bottom up and top down approaches, methods of preparation of nano material, plasma arching, chemical vapour, deposition, electro deposit, sol gel synthesis, ball-milling and use of natural nano particles.

Unit-V (15 hours)

Synthesis of nano materials: Instrumentation, principle and application of Scanning Electron Microscope (SEM)-Transmission Electron Microscope (TEM) - Atomic Force Microscope (AFM) - Scanning Tunnelling Microscope (STM).

Applications of Nano materials: Catalysis, environmental and biomedical (drug delivery) applications, Environmental hazards.

References

1. R. Booker &Boysen, "Nanotechnology"
2. M. Wilson, K. Kannanaraj, G. Smith, M. Simmous& R. Ragase, " Nanotechnology".
3. G. Timp, "Nanotechnology".
4. J. Yings, "Nanostructural materials".
5. A. R. West, "Solid State Chemistry", John Wiley and Sons
6. L. V. Azaroff, "Introduction to Solids", McGraw Hill, New York.
7. L. Smart, D. Moore and S. Thomas, "Solid State Chemistry- An Introduction", 2nd Ed

ORGANIC CHEMISTRY – II

Objective

1. To understand the basic concepts of pericyclic reactions.

2. To learn about the molecular rearrangements.

3. To know about the Conformational analysis and stereochemistry of organic compounds.

Unit – I (15 hours)

Pericyclic reactions: Electrocyclic reactions – molecular orbital correlation diagram and frontier molecular orbital (FMO) theory applicable to the electrocyclic conversionof 1,3 dienes and 1,3,5-trienes, [2+2] cycloadditions and [2+4] cycloadditions. Sigmatropic rearrangements – [1, 5] sigmatropic rearrangement, Claisen and Cope rearrangements.The perturbation theory of pericyclic reactions. Ene reactions and 1,3 dipolar additions.

Unit – II (15 hours)

Photochemistry: Introductory theory of light absorption- Jablonski diagram, Dissipation of excess energy of the excited molecules, radiative transitions- fluorescence phosphorescence, delayed fluorescence-e-type and p type. Radiative transitions involving more than one molecule-eximers, exciplexes. Radiationless transitions involving internal conversion and intersystem crossing, energy transfer- intermolecular and intramolecular photosensitisation and quenching. Photochemical reactions of ketones- Paterno-Buchi reaction, Norrish type I and type II teactions, cis-trans isomerisation, photo reduction and photo oxidation- Di-pi-methane rearrangement.

Unit – III (15 hours)

Molecular rearrangements – Wagner-Meerwein, Wolf, Sommelet-Hauser rearrangements, Neber rearrangement, Baeyer- Villiger rearrangement, Dakin reaction, Stevens, Wittig, Favorskii, Dienone-phenol, benzidine, Fries, Lossenrearrangements.

Unit – IV (15 hours)

Oxidation and reduction: Formation of C=C, C-C bonds by dehydrogenation- dehydrogenation by quinones, SeO_2, Hg(OAc) and Pb(OAc), formation of C-C bond in phenol coupling, Acetyline coupling, Allylic oxidation of alcohols, glycols, amines to aldehydes and ketones- Metal hydride reduction-Metal alkoxide reduction, reduction by dissolving metals- Clemmensen reduction, Wolf Kishner reduction, Metal ammonia reduction(Birch reduction)- reduction by nitrocompounds – acyloin condensation.

Unit - V (15 hours)

Conformational analysis and stereochemistry: Conformations of cyclohexane, substitiuted cyclohexane and decalins. Conformation and reactivity in substituted cyclohexanes.Assignments of R and S configuration in chiral non recemic molecules.Setreochemistry of biphenyl, allenes and spirances.Stereochemistry of sulphur and nitrogen compounds.

References

1. Jerry March, Advances organic chemistry (reaction mechanism and structure) Wiley Interscience.

2. C.H. Depu and O.C. Chapman, Molecular reactions and Photochemistry, Prentice Hall
3. S. Muherjee and S.P. Singh, Reaction mechanisms in organic chemistry
4. K. Nasipuri, Sterochemistry of organic compounds- Principles and applications. Wiley Eastern Ltd.
5. Jagadamba Singh, Photochemistry and Pericylic reactions. New Age Int. Pvt. Ltd.
6. I.L. Finar, organic chemistry Vol.II Stereochemistry and Chemistry of natural Products.
7. Organic reactions stereochemistry and mechanism by P.S. Kalsi, New Age international publishers
8. N. Tiwari, Advanced organic stereochemistry (Problems and solutions)
9. Jagdamba Singh and L.D.S. Yadav, Advanced Organic Chemistry, PragatiPrakashan, 2011
10. Jagdamba Singh and L.D.S. Yadav, Organic Synthesis, PragatiPrakashan, 2011

PHYSICAL CHEMISTRY –II

Objective

1. To get the knowledge of Chemical bonding
2. To understand the concept of statistical thermodynamics and electrochemistry
3. To learn about the principles and importance of photochemistry and adsorption

Unit – I Statistical Thermodynamics:I (15 hours)

Objectives of statistical thermodynamics - concept of thermodynamics and mathematical probabilities Permutation and combination. - Laws of probability. Distribution laws.Gaussian distribution.Distribution of distinguishable and non-distinguishable particles. Maxwell - Boltzmann distribution law - Fermi - Dirac and Bose - Einstein statistics - comparison with Maxwell - Boltzmann distribution law and their applications Fermi- Dirac Distribution Concept of ensembles Canonical and Grand canonical ensemble.

Unit – II Statistical Thermodynamics II (15 hours)

Partition function – Definition – Justification & Nomenclature – Barometric Distribution Law – Boltzmann Distribution – Relation between Total Partition Functions & Translational, Rotational Vibrational & Electronic Partition Functions – Ortho &para Hydrogen – Evaluation of Thermodynamic Properties (E, H, A and G, C_V and C_P, – Entropy of Monoatomic Molecules (Sackur – Tetrode Equation) and Calculation of Equilibrium Constants of Reactions.

UNIT – III (15 hours)

Chemical Kinetics I: Theories of Reaction rates – Arrhenius theory. Hard - sphere collision theory of gas – phase reactions. Absolute reaction rate theory (ARRT) for ideal gas reactions (in terms of partition functions). Relation between activated - complex theory and hard - sphere collision theory. Thermodynamic formulations of activated complex theory –potential energy sufaces – Kinetic isotopic effects- significance of volume of activation and entropy of activation (Perin's theory)

Unimolecular reactions – lindemann's theory –limitations –Hinshelwood theory – KRR theory (Kassel,Rice and Ramsperger theory) –Slater's treatment to diatomic molecule(only) –comparision of Slater's and - KRR theory.

UNIT – IV Chemical Kinetics II (15 hours)

Kinetics of Kinetics of complex reactions - consecutive reactions, parallel reactions, opposing reactions(unimolecular steps only). chain reactions- chain length - Semenoff-Hinshelwood mechanism of chain reactions and explosion.

Kinetics of fast reactions: Relaxation method, flow method, shock method, field jump method, pulse method and flash photolysis method.

Reactions in solution: Diffusion controlled reactions in solution-Debye smoluchowski equation-

- Effect of solvent on the reaction rates (ARR theory approach only) - influence of ionic strength on rates of reactions (Bronsted-Bjerrum equation).

Unit – V Catalysis and Adsorption (15 hours)

General characteristics of catalytic reactions -Specific and general acid - base catalysis.Bronsted catalysis law.Hammett acidity function-Zucker-Hammet hypothesis – Bunnett criterion. Enzyme

catalysis – mechanism and kinetics of enzyme catalysed reactions (single substrate reaction only)- Michaelis-Menten equation- Trun over number. Influence of pH and temperature

Adsorption – Types – adsorption isotherms (Freundlich & Langmuir) - adsorption and free energy relation– Gibbs adsorption isotherm – potential energy diagram and Lennerd-Jones plots – Heterogenous adsorption – BET isotherm. Role of surface in catalysis - semiconductor catalysis – Langmuir-Hinshelwood and Langmuir- Rideal-Eley mechanisms of heterogeneous catalysis by adsorption- Hydration of ethylene on Cu surface and decomposition of ammonia on Tungstun surface.

REFERENCES

1. N.M. Laurendeau, Statistical Thermodynamics Fundamentals and Applications
2. Lee, Sears and Turcotte – Statistical Thermodynamics;
3. Sears and Salinger, Thermodynamics, Kinetic theory and Statistical Thermodynamics;
4. Gupta, Statistical Thermodynamics
5. W.J. Moore, Physical Chemistry (1962).
6. P.W. Atkins, J. De. Paula, Atkin's Physical Chemistry, 8thEdn., Oxford University Press, Oxford, (2006).
7. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, 41stEdn., (2006).
8. Glasstone, Laidler and Eyring The Theory of Rate Processes
9. Pilling, Reaction Kinetics
10. Atkins, Physical Chemistry
11. Laidler, Chemical kinetics
12. Frost and Pearson, Kinetics and mechanism

Elective –II: PHYSICAL METHODS IN CHEMISTRY – I

Objective

1. To study the instrumentation and principles of analytical intruments
2. To aware the various applications of instruments in chemistry.

Unit – I (15 hours)

Nuclear methods and analysis: Statistical in measurement of radioactivity-coincidence correction-preparation and mounting of samples-tagging compounds-analysis with labelled reagents-isotope dilution analysis-liquid scintillation counting-activation analysis-absolute method-comparator method-limitations of activation analysis-application of activation analysis-isotope dilution method-applications of isotope dilution method.

Unit – II (15 hours)

Thermal methods of analysis: principle, instrumentation and application of thermogravimetry, differential thermal analysis and differential scanning calorimetry - thermometric titrations. Refractometry - theory, Abbe's refractometer and applications of refractometry.

Unit – III (15 hours)

Polarimetry – Plane polarised light – optical activity of molecules – polarimeter and its uses. ORD and CD spectrometry, circular birefringence, circular dichroism, optical rotatory dispersion, plain curves, anomalous curves – Cotton effect – axial haloketone rule and octane rule – application. Nephelometry and Trubidimetry – Principle, instrumentation and applications.voltametric and cyclicvoltametric, amprometic titration.

Unit – IV (15 hours)

Atomic Absorption Spectrometry: Principle – instrumentation – detection of metals &nonmetals, interference, detection limit & sensitivity and applications.

Flame Emission Spectrometry – Principle, instrumentation, methodology and applications. Comparison between AAS and FES.

Molecular fluorescence and phosphorescence – Theory, instrumentation and applications.

Unit –V Chromatography (15 hours)

Principles, theory, instrumentation and applications in chemical analysis of the following – column, paper, thin layer and ion exchange – GC, GLC and HPLC. Purification of some common organic solvents.

References:

1. B. K. Sharma, Chromatography, Goel Publishing House. (2004)
2. Gurdeep R. Chatwal& S. K. Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House (2003).
3. B. K. Sharma, Instrumental methods of Chemical Analysis, Goel Publishing House. (2003)
4. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International Publishers. (2010).
5. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers (2010).
6. Larry G. Hargis, Analytical Chemistry, Prentice Hall (1998).
7. B. K. Sharma, Chromatography, Goel Publishing House. (2004)
8. Gurdeep R. Chatwal& S. K. Anand, Instrumental Methods of Chemical Analysis, Himalaya Publishing House (2003).
9. B. K. Sharma, Instrumental methods of Chemical Analysis, Goel Publishing House. (2003)
10. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International Publishers. (2010).
11. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers (2010).
12. Larry G. Hargis, Analytical Chemistry, Prentice Hall (1998).

CORE PRACTICAL – 1
Inorganic Chemistry – I

Objective

1. To know the semi micro qualitative analysis in Inorganic chemsitry
2. To analysis the various rare earth elements qualitatively
3. To know the various inorganic complex preparations and priniciples of colorimetry

Qualitative Analysis

Analysis of at least four inorganic mixtures containing two commancations and two less common cations using semi micro method.(less common cationsThallium, Tungsten, Tellurium, molybdenum, Cerium, Thorium, Titanium, Zirconium, Vanadium, Beryllium, Uranium and Lithium) minimum four mixtures..

Preparations

Preparations of any five of the following complexes –Leadtetraacetate, Dipyridiniumhexachloroplumbate, Hydroxylaminehydrochloride, ortho and paraHydoxyphenylmercuric chloride, Potassiumcupricchloride. Chrom alum, copper(I)chloride,Trithioureacopper(I), Potassium trioxalatoaluminate(III), Potassium trioxalatochromate(III),

Colorimetric Estimations (Nessler's method)

Copper, Iron, Nickel, Manganese, Chromium and Lead.

References

1. V.V. Ramanujam- Semimicro Qualitative Inorganic Analysis.
2. V. Venkateswaran, R. Veeraswamy and A.R. Kulandaivelu - Principles of Practical Chemistry, Sulthan Chand & Sons.
3. S.Giri, D.N. Bajpai and O.P Panday – Practical Chemistry Vol I & II. S.Chand& company.

CORE PRACTICAL – 2

ORGANIC CHEMISTRY – I

Objective

1. To understand the separation and analysis procedure of organic mixture
2. To learn the single stage preparations of organic substances

Analysis of two component mixtures.(about five mixture)

Separation and Charecterisation of compounds.

Any five single stage preparations involving the following reactions.

Nitration, acylation, halogenations, diazotization, rearrangement, hydrolysis, alkylation, reduction and oxidation and preparations illustrating the following: Benzoin condensation, Cannizzaro reaction, Perkin reaction, Reimer – Tiemann reaction, Sandmeyer reaction, Fries rearrangement, Skraup synthesis –recrystallisation of product, melting point determination and calculation of percentage yield.

References

1. B.B. Day and M.V. Sitaram and T.R. Govindachari - Laboratory manual of Organic Chemistry. Allied publisers Ltd.
2. Gnanprakasam and Ramamurthy - Organic Chemistry Laboratory manual.
3. Jagmohan Advanced Practical Organic Chemistry, Vol, I & II

CORE PRACTICAL - 3

PHYSICAL CHEMISTRY - I

1. Determination of Heats of Solution of the given substance by Solubility method.

2. Determination of Molecular Weight by Rast's Micro method.

3. Determination of Solubility Product of Sparingly soluble salt.

4. Determination of the Strength of strong acid by Conductometric method.

5. Potentiometric Redox Titrations.

6. Potentiometric Acid – Base Titration.

7. Determination of pH using Quinhydrone by Conductometric method.

8. Determination of the Arrhenius Parameter.

9. Determination of the Strength of Weak acid by Conductometric method.

10. Determination of the Strength of Mixture of acids by Conductometric method.

11. Determination of the Strength of Buffer solution by Conductometric method.

12. Determination of pH of Buffer solution using Potentiometric Titration.

13. Freundlich Adsorption Isotherm.

14. Acid – Catalysed hydrolysis of Methyl acetate.

Books Recommended:

1. Practical Physical Chemistry – **Yadev**

2. Practical Physical Chemistry – **S. R. Palit and S. K. De**.

3. Practical Physical Chemistry – **V. Venkateswaran and A. R. Kulandaivelu**.

4. Practical Physical Chemistry by **B. Viswanathan and P. S. Raghavan**.

SEMESTER – III

INORGANIC CHEMISTRY – III

COORDINATION CHEMISTRY

Objective

1. To learn the various theories of coordination compounds

2. To study the various reaction of coordination compounds

3. To acquire the knowledge about bioinorganic chemistry

Unit – I (15 hours)

Theories of coordination compounds: VB theory-CFT-Splitting of d orbital in ligand field and different symmetries-CFSE-Factors affecting the magnitude of 10 DQ-Evidence for crystal field stabilization - Spectro chemical series – Site selection in spinels - tetragonal distortion from octahedral symmetry-John Teller distortion - Nephelauxetic effect-Mo theory octahedral-tetrahedral and Square planar complexes-pi bonding and molecular orbital theory-experimental evidence for pi-bonding.

Unit – II (15 hours)

Electronic and Magnetism: Microstates, terms and energy levels for $d^1 – d^9$ ions in cubic and square field-selection rules-band intensities and band widths-orgel and tanabe-sugano diagram-evolution of 10 DQ and β for octahedral complexes for cobalt and nickel-charge transfer spectra-magnetic properties of coordination compounds-charge in magnetic properties of complexes in terms of spin orbit coupling – temperature independent pare magnetism-spin cross over phenomena.

Unit – III (15 hours)

Metal carbonyls. methods of preparation, structure, bonding and reactions – carbonylate ions – carbonyl hydrides, carbonyl halides, --- Vaska's compound of molecular nitrogen and oxygen— Nitrosyl complexes. β- diketones- complexes of unsaturated hydrocarbons – alkanes, allyls and dienyls. 18- electron rule.

Unit – IV (15 hours)

Reactions: Substitution reaction in square planar complexes-the rate law for Nucleophilic substitution in square planar complexes-the trans effect-theories of trans effect-mechanism of Nucleophilic substitution in square planar complexes-kinetics of octahedral substitution –ligand field effect and reaction rate-mechanism of substitution in octahedral complexes –reaction rate influenced by acid and bases – racemization and isomerization-mechanism of redox reactions-outer sphere mechanism-exited outer sphere electron transfer reactions-inner sphere mechanisms-mixed valent complexes.

Unit – V (15 hours)

Bio Inorganic chemistry: Metalloporphyrins - chlorophyll, haemoglobin and myglobin-structure and functions of heamoglobin cytochromes.

Metalloenzymes - enzyme action, inhibition and restoration-carboxy peptidase-A and carbonic anhydrase-vitamin B_{12} and B_2, Co-enzymes.

Metalloproteins - nonheme iron proteins-rubredoxin and ferrodoxin-copper proteins and their classification-Nitrogenase, their structure and function, metal ions in biology-metal sodium ion pump-metal poisons and chelating agents in medicines.

References:

1. J.E Huheey, Inorganic Chemistry
2. F.A Cotton & Wilkinson, Advanced Inorganic Chemistry
3. B.N Figgis introduction to ligand fields, Wiley Eastern Ltd, New Delhi.
4. F. Basclo and R.G. Pearson, Mechanism in inorganic reactions.

SEMESTER – III

ORGANIC CHEMISTRY – III

Objective

1. To study the structural elucidation and synthesis of alkaloids

2. To study the structural elucidation and synthesis of terpenoids

3. To aware the use of various Reagents in organic synthesis and retrosynthetic methods

Unit – I (15 hours)

Natural plant pigments and co-pigments: Anthocyanins– structure of anthocyanidins and synthesis, flavones and isoflavones – structure and synthesis, Baker Venkataraman synthesis and kostanecki synthesis. Flavonol- structure and synthesis.

Chemotherapy: Penicillin, Chloramphenicol, Streptomycin and Tetracycline - structural elucidation and synthesis, uses and SAR (Structural Acivity and Relationship). Sulpha drugs- preparation and uses of sulpha pyridine and sulphathiazole, Mode of action of sulpha drugs.

Unit – II (15 hours)

Cholestrol- structural elucidation(synthesis not required) conversion of cholesterol into testosterone and progesterone. Ergosterol- Structural elucidation- Structural discussion of vitamin-D, Equilenin, oestrone -structure and synthesis.

Unit – III (15 hours)

Terpenoids- Isolation, classification, isoprene rule and special isoprene rule, Structural elucidation and synthesis of zingiberene, Beta eudesmol, caryophyllene and abetic acid and biosynthesis of terpenoids.

Unit – IV (15 hours)

Reagents in organic synthesis: Use of following reagents in organic synthesis and functional group transformations : Diborane, Grignard reagents, platinum and palladium catalyst, NBS, Selenium, Raney nickel, Ozone, 1,3 - Dithane, Gilmans reagent, Lithium diisopropylamide, dicyclohexylcarboidiimide, osmium tetroxide, DDQ, Wilkinsons catalyst and Woodward Prevost hydroxylation, Peterson synthesis, Sharpless assymmetric epoxidation.

Unit – V (15 hours)

Introduction to retrosynthesis: Synthon, synthetic equivalent, target molecule functional group interconversion, disconnection approach, importance of the order of the events in organic synthesis. Chemoselectivity, one group C-X, C-C disconnection (disconnection of alcohols and carbonyl compounds), protecting groups.

References:

1. I.L. Finar Vol.II, ELBS Longmann group
2. O.P. Agarwal, Natural Product chemistry, Goel publishing House
3. S. Warren, Organic synthesis The disconnection approach. Wiley and sons
4. S. Warren, Organic synthesis, The Synthon approach, 2nd edn, Wiley and sons

5. Jagdamba Singh and L.D.S. Yadav, Organic Synthesis, Pragati Prakashan, 2011.

PHYSICAL CHEMISTRY – III

Objective

1. To study the principles of statistical thermodynamics

2. To learn the importance of corrosion and its inhibitions

UNIT – I Ionic equilibria and Ionic Conductance (15 hours)

Arrhenius theory of ionisation – migration of ions- transport number – concept of strong and weak electrolyte – oswald's dilution law – limitations – theory of strong electrolyte – ghosh's formula- degree of dissociation- common ion effect –solubility equilibria and solubility product. Salt hydrolysis – bronsted Lowry concept of hydrolysis – NaCl neutrality (only).

Ionic Conductance- Debye-Huckel theory - Electrode reactions in strong electrolytes -Debye-Huckel-Onsager equation – verification – Wien effect and Debye-Falkenhagen effect - Ionic strength – activity and activity coefficient – Debye-Huckel limiting law – activity coefficient at higher concentrations.

Unit - II Electrode kinetics in solutions (15 hours)

Electrode – Electrolytic interface – electrical double layer – electrocapillary thermodynamics – Lippman equation – Measurements of double layer capacitances – Theoretical models of double layers – Helmholtz and Guoy-Chapman models – Stern model.

Electrode Kinetics - Butler-Volmer equation – the transfer coefficient – double layer effects – The Tafel equation – Charge transfer resistance – reversibility and irreversibility in electrochemical reactions – Nernst relation from Butler-Volmer relation – the effect of electrode on electron transfer rate – Hydrogen evolution reaction as a case study – processes associated with electron transfer – mass transfer effects – over voltages - – applications of over voltage (electro deposition of metals in solution and corrosion of metals only)

Unit – III Electro chemical cells (15 hours)

Electrode – Electrolyte equilibrium: Electrodes- Classification of electrodes- EMF concept -Origin of electrode potential- Nernst equation in terms of activity. Electrochemical cells – conventions in constructing cells -Concentration cells –types - Liquid junction potential- concentration cells with and without liquid junction potential - Concentration cells and activity coefficient determination. Primary and secondary batteries(lead acid, Ni –Cd and Lithium ion batteries only) - Fuel cells- H_2-O_2 fuel cell, fuel cell for high temperature applications.

Unit – IV Corrosion and its control (15 hours)

Corrosion- Introduction- definition- consequences of corrosion. Theories of corrosion- dry corrosion- wet or electrochemical corrosion- rate expression. Forms of corrosion- Galvanic – Crevice- Pitting corrosion.

Corrosion monitoring techniques- weight loss method- electrical resistance measurement- linear polarisation resistance- potentiodynamic and galvanodynamic polarisation- electrochemical impedance spectroscopy

Corrosion Prevention- anodic and cathodic protection- application of coatings- types of coatings. Hot dipping metal cladding- cementation- electroplating- anodising - enamel coating- Paints (basic idea only). Corrosion inhibitors.

Unit – V Current–voltage relationships (15 hours)

Current–voltage relationships – mass transfer – diffusion limited currents – kinetic currents – adsorption currents – Fundamental principles of coulometric methods. Constant current and controlled potential methods. Simple applications. . Polarography: concentration polarization – concept of supporting electrolyte - The dropping mercury electrode- Diffusion current- . Half – wave potent half wave potential – Ilkovic eqution – Derivation of Ilkovic eqution from Fick's Laws of

diffusion- Applications of polarography. Voltametry – cyclic voltametry and its applications. chronopotentiometry and Tensammetry(Basic principles only). Amperometric titrations- Dead stop end point method – advantages and disadvantages of amperometry- applications.

REFERENCES

1. W.J. Moore, Physical Chemistry (1962).
2. P.W. Atkins, J. De. Paula, Atkin's Physical Chemistry, 8th Edn., Oxford University Press, Oxford, (2006).
3. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandar, 41st Edn., (2006).
4. Crow, Principles and Applications of Electrochemistry
5. Koryta and Drorek, Principles of Electrochemistry
6. Rieger, Electrochemistry
7. Bockris and Reddy, Modern Electrochemistry (Vol. I & II)
8. Glasstone, Introduction to Electrochemistry
9. Moore, Physical Chemistry
10. Sharma, Instrumental Methods of Chemical Analysis
11. Ewing, Instrumental Methods of Chemical Analysis
12. Bard and Faulkner, Electrochemical Methods;
13. Pletcher, Industrial Electrochemistry
14. Vincent et al., Modern batteries – Introduction to Electrochemical Power Sources;
15. Bockris and Reddy, Modern Electrochemistry (Vol. II);
16. Fontana, Corrosion Engineering;
17. Banerjee, Introduction to the Science of Corrosion and its Inhibition
18. Chemical analysis, Sri Vatsava.
19. Physical Chemistry by D.N. Bajbai

SEMESTER – IV

INORGANIC CHEMISTRY – IV

ORGANO METALLIC AND BIO INORGANIC CHEMISTRY

Objective

1. To know about the structure and bonding in organometallics

2. To study the various reactions of organometallics

3. To get the knowledge of bioinorganic chemistry.

Unit – I (15 hours)

Structure: Inorganic chains-rings-cages and cluster- catenation - heterocatenation-intercalation chemistry-one dimensional conductor-isopolyanions-heteropolyanions-borazines-phosphazenes-phosphazene polymer-ring compounds of sulphur and nitrogen-homocyclic inorganic system-cages-boron cage compound – metal cluster - dinuclear cluster-trinuclear cluster-tetranuclear cluster-hexanuclear cluster-structure predation of organometallic clusters.

Unit – II (15 hours)

Phosphines-metal alkyls, aryls, hydrides and dihydrogen complexes-pi-bonding ligands-electronic structure and bonding in ferrocene- synthesis, physical and spectroscopic properties of metallocenes, fluxional molecules.

Organo Metallic Catalysis --- Alkene hydrogenation, Hydroformylation, Monsanto acetic acid process, Wacker process.

Unit – III (15 hours)

Cyclopentadienyl complexes: Metallocenes: synthesis of metallocenes-bonding in metallocenes - reactions of metallocenes- Cp_2Fe/Cp_2Fe^+ couples in biosensors-bent sandwich complexes-bonding in bent sandwich complexes - metallocenes halides and hydrides-metallocenes and stereospecific polymerization of l-alkenes – cyclopentadiene as a non-spectator ligand –monocyclic pentadienyl (half sandwich) complexes - synthesis and structure of allyl and arene complexes-multidecker complexes.

Unit – IV (15 hours)

Organometallic compound reactions: Organometallic compounds in homogeneous catalytic reactions-coordinative unsaturation-acid-base behaviour reactions-insertion reactions-reactions of coordinated ligands-catalytic reactions of alkenes, palladium catalysed cross coupling reactions in organic synthesis.

Unit – V (15 hours)

Chemotheraphy: Chemotherapy with compounds of certain non-essential elements: platinum complexes in cancer therapy, Cisplatin and its mode of action – cytotoxic compounds of other metals-Gold containing drugs as anti-rheumatic agents and their mode of action-Lithium in pschycopharmological drugs. -- Compounds of Arsenic (Arsenous anhydride, Sodium Arsenate,

Aromatic Arsenicatls) – Iron (Ferrous fumarate, Ferrous gluconate, Ferric ammonium citrate) --- Mercury (Mercurous chloride, Ammoniate mercury, Grew powder).

Biological role of I_2, Cu & Zn.

References:

1. J.E. Huheey, Inorganic Chemistry, 3rd Ed, Harper and Row publishers
2. F.A Cotton & Wilkinson, Advanced Inorganic Chemistry
3. S.J. Lippard, J.M. Berg, Principles of Bioinorganic Chemistry, Panima pub (2005)
4. W. Keim, B. Schewederski, Bioinorganic, Inorganic elements in the Chemistry of Life, John Wiley & sons 1994.
5. J. Haiduc and J.J. Zuckermann, Walter-de-Gruyter, Basic Organometallic Chemistry, Berlin, 1985
6. K.F. Purcell, J.C. Kotz, Inorganic Chemistry, Golden Sumburst series 1997.

SEMESTER – IV

ORGANIC CHEMISTRY – IV

Objective

1. To study the various natural plant pigments and co-pigments and their structures

2. To learn about heterocyclics and its structure

3. To know the preparation and synthetic applications of organometallic compounds in organic chemistry.

Unit – I (15 hours)

General methods of ascertaining structure of alkaloids. Structural elucidation and synthesis of quinine, morphine, codeine, thebaine and brucine.

Unit – II (15 hours)

Polypeptides-General principles of polypeptides synthesis, Bergmann and Sheehan et. al methods and solid state peptide synthesis. Proteins- characteristics, classification, end group analysis, primary, secondary and tertiary and quaternary structures. Oxytocin –structure and synthesis, Enzymes and coenzymes. Structure of RNA and DNA and their biological importance.

Unit – III (15 hours)

Nomenclature – reactivity – aromaticity – spectral properties. Elementary study of the following systems only – oxazole, imidazole, thiazole, pyrimidine, pyridazine, carbazoles, uracil and uric acid.

Unit – IV

Introduction of Green Chemistry

The need for green chemistry – twelve basic principles of green chemistry - eco efficiency – environmental protection laws, challenges – pollution control and pollution prevention – green methods, green products, recycling of waste – inception of green chemistry – awards for green chemistry – international organizations promoting green chemistry.

Solvent Free Organic Synthesis

Solvent free organic synthesis – microwave assisted synthesis – microwave activation, microwave heating – advantages of microwave exposure and specific effects of microwaves – Organic synthesis under microwaves – benefits, limitations, equipments – Reactions on solid supports, phase transfer catalysis, solvent free esters saponification – Reactions without support or catalyst – examples – microwave assisted reactions in water – oxidation of toluene to benzoic acid.

Unit – V

Designing Green Synthesis

Green Synthesis – Designing, Choice of starting materials, choice of reagents, choice of catalysts – bio catalysts, polymer supported catalysts, choice of solvents – Synthesis involving basic principles

of green chemistry – examples – synthesis of adipic acid, methyl methacrylate, paracetamol – Ultrasound assisted reactions – esterification, reduction, coupling reactions.

References:

1. Paul T. Anastas Green Chemistry
2. Sanghi A Shrivastav Green Chemistry.
3. M.Kidwai & Ahlavalia V.K.Green Chemistry
4. V.Kumar, An Introduction to Green Chemistry, Vishal Publishing Co., Jalandhar, 2007.
5. I.L. Finar Vol.II, ELBS Longmann group
6. O.P. Agarwal, Natural Product chemistry, Goel publishing House
7. Principles of organic synthesis- Sir Richard Norman and James M.Coxon, Chapman & Hall publishers
8. Raj K. Bansal Organic Chemistry Reaction Mechanisms in organic chemistry, Harper & Row Publishers.

ELECTIVE PAPER - III
Analytical Chemistry

Objective

1. To know the computational methods in chemistry
2. To acquire the various experimental techniques and its applications in chemistry
3. To explore the knowledge of the research methodologies in chemistry

Unit – I (15 hours)

Significant figures, errors – determinate and indeterminate, precision, mean, median, mode, average deviation, standard deviation (sample and population) – relative standard deviation – accuracy, difference between precision and accuracy, propagation of determinate errors, reporting of analytical data – uncertainty, statistical treatment of analytical data – Confidence limits, Student's t-values for various probability levels and varying degrees of freedom.

Unit - II

Chemical Analysis: Non-destructive techniques: Wavelength and energy dispersive X-ray fluorescence spectroscopy (WDS and EDS); X-ray absorption spectroscopy (XANES and EXAFS); secondary ion mass spectrometry (SIMS); temperature programmed desorption (TPD); thermal desorption spectroscopy (TDS). Destructive techniques: inductively coupled plasma-atomic emission spectroscopy (ICP-AES).

Potentiometric methods: Measurement of pH. Potentiometric titrations- redox and precipitation titrations.of Copper. Separation of metals. Conductometric titrations: Principle and types.

Unit-III (15 hours)

Preparative methods: Solid state reaction, chemical precursor method, co-Precipitation, sol-gel, metathesis, self-propagating high temperature synthesis, ion exchange reactions, intercalation / deintercalation reactions; hydrothermal and template synthesis; High pressure synthesis. Methods of Single Crystal Growth: Solution growth; Melt Growth-Bridgeman, Czochralski, Kyropoulus, Verneuil; Chemical Vapour Transport; Fused Salt Electrolysis; Hydrothermal method; Flux Growth Characterization.

.**Unit – IV Survey of Literature** (15 hours)

Sources-Primary and Secondary sources-Journals, Papers, reviews, communications, notes, patents, Journals of different fields of chemistry (Organic, Inorganic, Physical, Polymer, Pharmaceutical, Industrial and Analytical). Titles, importance of categorization and their importance, Abbreviations of names, Nomenclature of compounds and their usage.

Abstracts-Types (Chemical, Physical, Analytical), Survey of abstract indexes, author index, general technique index, collective and comprehensive indices, Aids of computer devices in literature survey.

Specific articles of science citation cards and indices, summarizing the works already done and published in the chosen field,

Unit – V Proposal, Paper and Thesis writing (15 hours)

Assignment and test papers, Thesis and dissertations, style and conventions in writing, selection of topic.

Rough drafting of the article, Title, Abstract, Literature review, Problem and time limitation, Experimental methods. Results and Discussions. Foot notes, Figures, Data presentations, Tables, Sign convention followed, Bibliography, Conclusions and recommendations.
The general format, Page and chapter formate. Use of quotations.food note, tables and figures. Resulta and Discussions, applicability of the findings to common usage, referring, abbreviations used etc.,

References

1. A.W. Adamson, "Physical Chemistry of Surfaces", Wiley India.
2. G.A. Somorjai and Y. Li, Introduction to Surface Chemistry and Catalysis.
3. F.W. Sears and G.L. Salinger, An Introduction to Thermodynamics, Kinetic Theory of Gases and Statistical Mechanics", Addison wisely.
4. L.K. Nash, "Elements of Statistical Thermodynamics", Addison Wesley Publishing Co.
5. McQuarrie, "Statistical Mechanics", Orient Longman
6. D. Chandler. Introduction to Modern Statistical Mechanics, Oxford University Press.
7. D.A. Skoog, D.M. West and F.J. Holler," Fundamentals of Analytical Chemistry",
8. R. Wiesendanger, Scanning Probe Microscopy and Spectroscopy, Cambridge University Press, 1994.
9. Frank A. Settle, Handbook of instrumental techniques for analytical chemistry, Prince Hall, New Jersey, 1997.
10. D. A. Skoog, D. M. West, F. J. Holler and S. R. Couch, Fundamentals of analytical chemistry. Brooks/ColeCengage learning, New Delhi, 2004.
11. R. L. Dominoswki, Research Methods, Prentice Hall, 1981.
12. Gibaldi, J. Achtert, W. S. Handbook for writers of Research Papers; 2nd ed.; Wiley Eastern, 1987.
13. Joseph, A. Methodology for Research; Theological Publications: Bangalore, 1986.

CORE PRACTICAL – 4

INORGANIC CHEMISTRY –II

Objective

1. To develop the experimental skills in complexometric titrations.

2. Understanding the practical knowledge in volumetric and gravimetric estimation.

3. The ability to work in Quantitative estimations and preparations.

Titrimetry:

Oxidation using ceric salts; Complexometric titration involving estimation of calcium, magnesium, nickel, zinc and hardness of water using EDTA

Chromatography:

Column, paper thin layer and ion – exchange.

Titrations in non – aqueous solvents.

Preparation:

Analysis and study of co-ordination complexes.(Potassium trioxalatoferrate(III), Hexaamminecobalt(III) chloride, Chloropentaamminechromium(III) chloride, Aquopentaamminechromium(III) nitrate Tetraamminecopper(II) sulphate, Ammonium hexachloro stannate.)

Quantitative estimation:

Mixture of cations involving volumetric and gravimetric estimation: Copper and Nickel, Copper and Silver, Copper and Magnesium, Iron and Nickel, Iron and Magnesium, Calcium and Barium.

References

1. V.V. Ramanujam - Semimicro Qualitative Inorganic Analysis.
2. V. Venkateswaran, R. Veeraswamy and A.R. Kulandaivelu - Principles of Practical Chemistry, Sulthan Chand & Sons.
3. J.Bassart, R.C. Denny, G.H. Jeffery Vogel and Mendham - Text Book of Qualitative Inorganic Analysis – The ELBS & Longman.

CORE PRACTICAL – 5

ORGANIC CHEMISTRY – II

Objective

1. To develop the experimental skills in quantitative estimations of organic compounds.

2. To improve the practical skill in Extraction and estimation of active constituents

Quantitative Estimation:

Estimation of phenol, aniline glucose and ketones.

Analysis of Oil:

Iodine value, Saponification value and Acetyl value.

Extraction and estimation of active constituents:

a) Lactose from milk

b) Caffeine from tea

c) Nicotine form tobacco extract

d) Citric acid or ascorbic acid from a tablet or from a natural source

Preparations:

About five, two stage preparations from literature.

References

1. B.B. Day and M.V. Sitaram and T.R. Govindachari - Laboratory manual of Organic Chemistry. Allied publisers Ltd.
2. Gnanprakasam and Ramamurthy - Organic Chemistry Laboratory manual.
3. Jagmohan Advanced Practical Organic Chemistry, Vol, I & II

CORE PRACTICAL - 6

PHYSICAL CHEMISTRY - II

1. Spectrophotometric Determination of Concentration of Metal ions like Cu & Fe.

2. Evaluation of First Order Rate Constant by Potentiometric method.

3. Adsorption characteristics of Acetic Acid on Charcoal.

4. Determination of Cell Constant, Verification of Onsager's Equation and Determination of Equivalent Conductance at Infinite Dilution of Strong Electrolytes.

5. Verification of Ostwald's Dilution Law and Determination of Dissociation Constants of Weak Acids.

6. Verification of Walden's Rule.

7. Conductometric Determination of Critical Micelle Concentration.

8. Dissociation of Weak Acid by Potentiometric Titration.

9. Determination of Very Low Concentration of Metals in Solution by Flame Photometry.

10. Inversion of Sucrose by Polarimetry method.

11. Determination of Order of Saponification of Ethyl Acetate with NaOH.

12. Determination of Relative Strength of Acids (HCl & H_2SO_4) by Ester Hydrolysis.

13. Phase diagram of Binary system.

14. Phase diagram of Ternary system.

(New Experiments may also be added)

Books Recommended:

1. Findlay's Practical Chemistry – Revised by **J. A. Kitchner** (Vedition)

2. Experimental Physical Chemistry by **F. Daniels and J. Williams**.

3. Experimental Physical Chemistry by **R. C. Das and B. Behera**.

4. Practical Physical Chemistry by **B. Viswanathan and P. S. Raghavan**.

Internal Marks: 30

1. Internal Test (Two test)	30
2. Model test (As per EOS exam pattern)	
(Covert into 40)	40
3. Assignment	20
4. Seminar	10
Total	100 (Covert into 30)

M.Sc. CHEMISTRY – EOS Examinations

Question Paper Pattern

Section – A

One mark questions (10)	(10 X 1)	= 10
(Answer in one or two sentenses)		

Section – B

Four mark questions (either or type)	(5 X 4)	= 20
(Two questions from each unit)		

Section – C

Eight mark questions (either or type)	(5X 8)	= 40
(Two questions from each unit)		
Total		**= 70**

SUPPORITIVE PAPER

(For other major students)

CHEMISTRY IN DAY TO DAY LIFE

Objective

1. To learn about the basic concepts of water treatment.

2. To develop the knowledge in the uses of fertilizers and polymers.

Unit - I (18 hours)

Water treatment: Standards for drinking water, Methods of Treatment of water for domestic and industrial purposes: Sedimentation, Coagulation, Filtration, Sterilization, Break point, chlorination. Determination of alkalinity of water, Hardness of water: Units, determination.
Demineralization of water.
Softening of water: Lime-soda Process, Ion exchange process, Zeolite process.

Unit – II (18 hours)

Fertilizers and pesticides - classification - characteristics and uses - pesticides and insecticides and its health effects.

Petroleum: Petroleum, cracking, Synthetic petrol, Refining of gasoline, Reforming, Chemical structure of fuel and knocking. Octane Rating of fuels, Cetane Rating, Diesel engine fuel, Kerosene, LPG as a fuel.

Unit - III (18 hours)

Dyes - classification based on mode of application and structure - paints - ingredients - drying - pigments - types and properties - varnish. Manufacture of dyes.

Unit - IV (18 hours)

Soaps and detergents - classification - ingredients - solids and liquids - disinfectants (phenyl, Dettol type) - perfumes - raw materials - perfumes used in soaps - cosmetics and agarbatti. Cosmetics: Talcum Powder, Tooth pastes, Shampoos, Nail Polish, Perfumes, soaps, and detergents

Unit - V (18 hours)

Polymers- classification, Preparations, Properties, Uses – PVC, Polyethylene, Nylon 66, Phenoxy resins, Epoxy resins, Buna-N rubber, Buna-S rubber, Natural rubber, Difference between Natural & Synthetic polymers.

Pharmaceuticals: manufacturing process of aspirin, vitamin A and paracetamol.

Adulterants: Adulterants in milk, ghee, oil, coffee powder, tea, asafoetida, chilli powder, pulses and turmeric powder - identification. Colour chemicals used in food-soft drinks and its health hazards.

M.Sc. CHEMISTRY – EOS Examinations

Question Paper Pattern

Section – A

One mark questions (10) (10 X 1) = 10

(Answer in one or two sentenses)

Section – B

Four mark questions (either or type)	(5 X 4)	= 20
(Two questions from each unit)		
Section – C		
Eight mark questions (either or type)	(5X 8)	= 40
(Two questions from each unit)		
Total		= 70