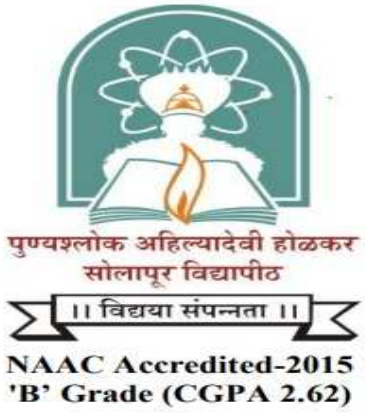
Punyashlok Ahilyadevi Holkar Solapur University, Solapur



Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: MEDICINAL CHEMISTRY

Name of the Course: M.Sc. I (Sem.– I & II)

(Syllabus to be implemented from w.e.f. June 2019)

M.Sc.I

(w.e.f. June 2019)

1. M. Sc. I (Chemistry)(Medicinal chemistry)

The above course is of two year duration consisting of four Semesters (first year:Semester I and II, second year: Semester III and IV).

Course structure of first year

Semester I

Paper HCT(1.1): Inorganic Chemistry I

Paper HCT (1.2): Organic Chemistry I

Paper HCT(1.3): Physical Chemistry I

Paper SCT(1.1): Analytical Chemistry I

Semester II

Paper HCT(2.1): Inorganic Chemistry II

Paper HCT (2.2): Organic Chemistry II

Paper HCT (2.3): Physical Chemistry II

Paper SCT(2.1): Instrumental methods of analysis

Syllabus

The syllabus has been prepared taking into consideration the present and near future needs of the industries & academic institutes, SET, NET, UGC guidelines, and syllabi of other advanced established Universities and as per the national needs. The students will be exposed to the basic as well as advanced & upto date knowledge of the subject.

M. Sc. Part I (Semester I)

Inorganic Chemistry – I (HCT 1.1)

1. Wave Mechanics (12)

Origin of quantum theory, black body radiation, atomic spectra, photoelectric effect, matter waves, wave nature of the electron, the wave equation, the theory of hydrogen atom, particle in one dimensional box, transformations of coordinates, separation of variables and their significance

2. Stereochemistry and Bonding in Main Group Compounds (08)

VSEPR theory, Walsh diagrams (tri and penta-atomic molecules) dπ – pπ bonds, Bent rule and energies of hybridization, some simple reactions of covalently bonded molecules

3. Chemistry of Transition Elements (12)

General characteristic properties of transition elements, co-ordination chemistry of transition metal ions, ligand field theory, ligand field energy parameters(Racah parameters B and C, Slater Condon Parameters, Slater Condon Shortley Parameters), splitting of d orbitals in low symmetry environment, Janh-Teller effect, interpretation of electronic spectra including charge transfer spectra , spectrochemical series, nephelauxetic series, metal clusters, metal carbonyls

4. Electronic, Electric and Optical Behavior of Inorganic Materials, (08)

Metals, insulators and semiconductors, electronic structure of solids, band theory,

intrinsic and extrinsic semiconductors, doping of semiconductors and conduction mechanism, semiconductor devices, rectifiers, transistors, optical devices, photoconductors, photovoltaic cell.

5. Metallurgy (08)

Occurance,extraction, properties and applications of copper, silver, gold, tin and lead.

RECOMMENDED BOOKS

1. A. F. Wells, Structural Inorganic Chemistry – 5th Edition (1984)
2. James H. Huheey, Inorganic Chemistry- Principle, Structure and Reactivity, Harper and Row Publisher Inc., New York (1972)
3. J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman and Hall, London
4. A.R. West, Solid State Chemistry and its applications, Plenum
5. N.B. Hanny, Solid State Physics
6. H.V. Keer, Solid State Chemistry
7. S.O. Pillai, Solid State Physics
8. W.D. Callister, Material Science and Engineering: An Introduction
9. R. Raghwan, First Course in Material Science
10. R.W. Cahan, The coming of Material Science
11. A.R. West, Basic Solid State Chemistry, 2nd Edition
12. U. Schubest and H. Husing, Synthesis of Inorganic Materials, Wiley VCH (2000)
13. M.C. Day and Selbin, Theoretical Inorganic Chemistry, Reinhold, EWAP
14. A.H. Hanny, Solid State Chemistry, A.H. Publication
15. John Wullf, The Structure and Properties of Materials, Vol. 4, Electronic properties, Willey Estern
16. L.V. Azoroff and J.J. Brophy, Elecronic Processes in Materials, Mc Graw Hill –I
17. Prakash G. More, Comprehensive Industrial Chemistry, Pragati Prakashan, Meerut
18. F.A. Cotton and R.G. Wilkinson, Advanced Inorganic Chemistry
19. Williams and L. Jooly, Modern Inorganic Chemistry
20. Manas Chanda, Atomic Structure and Bonding
21. N.N. Greenwood and A. Earnshaw, Chemistry of Elements, Pergamon
22. Chakrabarty, Solid State Chemistry, New Age International
23. S.J. Lipard and J.M. Berg, Principles of Bioinorganic Chemistry, University Science Books
24. G.L. Eichhron, Inorganic Bichemistry, Vol I and II, Elsevier
25. J.J. Lipard, Progress in Inorganic Chemistry, Vol 18 and 38, Wiley
26. E. Konig, Structure and Bonding, Vol 9, 1971, 175

M.Sc. I (Semester I)

Organic Chemistry-1 (HCT 1.2)

1. Reaction Mechanism: Structure and Reactivity **(8)**

Types of reactions, potential energy diagrams, transition states and intermediates. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes.

Acid and Bases: Bronsted and Lewis acids and bases, pH and pKa, Hard and soft acids and bases, strength of acids and bases.

2. Aliphatic Nucleophilic substitutions: **(8)**

The SN^2, SN^1 and mixed SN^1& SN^2 and SET mechanism and stereochemistry, SN^i mechanism and stereochemistry. Nucleophilic substitutions at an allylic, aliphatic trigonal and vinylic carbons. Reactivity effect of substrate structure, effect of attacking nucleophiles, leaving groups and reaction medium, phase transfer catalyst, ambident nucleophiles, Neighbouring Group Participation.

3. Aromatic Electrophilic Substitutions: **(8)**

Introduction, the arenium ion mechanism, orientation and reactivity in Nitration, Sulphonation, Friedel-Crafts and Halogenation in monosubstituted aromatic systems, energy profile diagrams. The ortho / para ratio, ipso attack, orientation in other ring systems (naphthalene, anthracene, 6 and 5 membered aromatic heterocyclic compounds). Diazo-coupling, Vilsmeir reaction, Gatterman-Koch reaction. Nucleophilic aromatic substitution reactions SN^1 ,SN^2 and Arynes.

4. Addition to Carbon–Carbon Multiple Bonds (6)

Mechanism and stereochemical aspects of the addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemo – selectivity, orientation and reactivity. Michael reaction. Sharpless asymmetric epoxidation.

5. Elimination Reactions: (4)

The E1, E2 and E1cB mechanisms. Orientation in Elimination reactions. Reactivity: effects of substrate structures , attacking base, the leaving group, the nature of medium on elimination reactions, comutation between substitution and elimination reactions, pyrolytic elimination reactions.

6. Rearrangements: (6)

Study of following rearrangements with mechanism and stereochemistry**:** Beckman, Fries, Hoffman, Schmidt, Curtius , Losses, Claisen & Benzilic acid**.**

7. Stereochemistry: (8)

Concept of Chirality: Recognition of symmetry elements and chiral structures, Prochiral relationship. Lexemic modifications and their resolution. R and S nomenclature. Geometrical isomerism, E and Z. Nomenclature., Erythro- and Threo-nomenclature, Conformational analysis of disubstituted cyclohexanes, optical activity in the absence of chiral carbon i.e. stereochemistry of biphenyls, allenes and spiranes.

RECOMMENDED BOOKS

1) A guide book to mechanism in Organic Chemistry (Orient-Longmens)- Peter Sykes
2) Organic reaction mechanism (Benjamin) R. Breslow
3) Mechanism and structure in Organic Chemistry (Holt Reinh.)B. S. Gould.
4) Organic chemistry (McGraw-Hill) Hendrickson, Cram and Hammond.
5) Basic principles of Organic Chemistry (Benjamin) J. D.Roberts and M. C. Caserio.
6) Reactive Intermediates in Organic Chemistry (John Wiley) N. S. Issacs.
7) Stereochemistry of Carbon compounds. (McGraw-Hill)E.L.Eliel
8) Organic Stereochemistry (McGraw-Hill) by Hallas.
9) Organic reaction mechanism (McGraw-Hill) R. K. Bansal.
10) Organic Chemistry- R. T. Morrison and R. N. Boyd,(Prentice Hall.)
11) Modern organic reactions (Benjumin) H. O. House.
12) Principle of organic synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
13) Reaction mechanism in Organic Chemistry- S. M. Mukharji and S. P. Singh.
14) Stereochemistry of Organic Compounds) D. Nasipuri.
15) Advanced Organic Chemistry (McGraw-Hill) J. March.
16) Introduction to Stereochemistry (Benjumin) K. Mislow.
17) Stereochemistry by P. S. Kalsi (New Age International)

M.Sc. I (Semester I)
Physical Chemistry-I (HCT 1.3)

1. Chemical Thermodynamics [19]

Review of Thermodynamics laws, Thermodynamic relation between C_p and C_v, concept of entropy, Derivations of Maxwells Relations, Thermaodynamic equation of state, Third law of thermodynamic and calculation of entropy, residual entropy. Concept of fugacity and determination of fugacity , Activity and activity coefficients of solute and solvent, their determination by freezing point depression and vapour pressure measurement criteria for equilibrium between phases, Derivation of phase rule, application of phase rule to three component system.

Thermodynamics of ideal solutions, Raoult's and Henrey's law, Excess functions for Non- ideal solutions and their determination.

2. Kinetic Theory of Gases [10]

Introduction, Molecular Statistics, The distribution of molecular states, Boltzmann law for distribution of molecular velocities, physical significance of the distribution law, Derivation of expressions for average, root mean square and most probable velocity.

3. Colloids and macromolecules [10]

Sols: Lyophilic and Lyophobic sols, properties of sols, coagulation, surface tension, surfactants and critical micelle concentration.

Macromolecules: Chemistry of polymerization: mechanism of polymerization Free radical polymerization, initiation, propagation and termination. Kinetics of free radical polymerization, Step growth polymerization (Polycondensation), Kinetics of step growth polymerization, cationic and anionic polymerization. Molecular weight of polymer, Number average, weight average, Viscosity average molecular weight, numerical problems on molecular weights. Degree of polymerization and molecular weight,

methods of determination of molecular weights: Osmometry, Viscometry, Light scattering, methods of diffusion and ultracentrifugation.

4. Fast Reactions: **[9]**

Study of kinetics by stop-flow technique, relaxation method, flash photolysis and magnetic resonance method, pressure jump method.

(More stress should be given in solving the numerical problems).

RECOMMENDED BOOKS

1. Physical Chemistry- P.W. Atkins
2. Text book of physical chemistry- S.Glasstone
3. Principles of Physical Chemistry – Marron and Prutton
4. Physical Chemistry- G.M.Barrow
5. Thermodynamics for chemists – S.Glasstone
6. Thermodynamics – Lewis and Randall, revised by Pitzer
7. Physical Chemistry of macromolecules –D D.Deshpande
8. Polymer Chemistry – F.Billimeyer
9. Kinetics and Mechanism – Frost and Pearson
10. Chemical and Kinetics by K. J. Laidler

M.Sc.- I (Semester I)

Analytical Chemistry I (SCT1.1)

1. Errors and treatment of Analytical Chemistry: (**12)**

Errors, Types of Errors: Determinate, constant, proportional and indeterminate; Significant figures and computation rules, Accuracy and precision, Distribution of random errors, Average deviation and Standard deviation, Variance and Confidence Limit, Least Square method.

Methods of Sampling, Sample Size, Techniques of Sampling gases, liquids, fluids, Solids and particulates.

2. Chromatographic Methods (12)

General principles, Classification of Chromatographic methods. Nature of partition forces, Chromatographic behavior of solutes, coloumn efficiency and resolution. Gas Chromatography**:** Theory and Instrumentation, column types, solid-liquid stationary phases, column switching techniques, basic and specialized detectors, element detection, chiral separation, pyrolysis GC, high temperature techniques, Applications (clinical and petrochemical) .

High Performance Liquid Chromatography: Theory and instrumentation, adsorption chromatography, liquid-liquid partition techniques, microbore and capillary chromatography, affinity techniques, size exclusion, ion pair separation, chiral and isotope separation and applications.

Ion chromatography

3. Electroanalytical Techniques: (12)

Polarography: - Introduction, Instrumentation, Ilkovic equation and its verification. Derivation of wave equation, Determination of half wave potential, qualitative and quantitative applications

Amperometry: - Principles, instrumentation, nature of titration curves, analytical applications.

Voltametry: - principle and instrumentation

4. Computer for Chemists: (12)

Introduction: Software: Overview of the key elements of basic programme structure, loops, arrays, mathematical functions. User defined functions, Conditional statements, strings, Applications, Data representation, Computerized instrument systems, Microcomputer interfacing.

Linear regression, X-Y plots, numerical integration and differentiation, operating with softwares such as PCMODEL, WINMOPAC, word processing, use of MSWORD, powerpoint and EXCEL in chemistry, use of internet.

RECOMMENDED BOOKS

1. Analytical Chemistry (J.W.)-G. D. Christian.
2. Introduction to Chromatography.1) Bobbit,2) Srivastva.
3. Instrumental Methods of Analysis (CBS)-H. H. Willard, L. L. Merrit, J. A. Dean & F. A. Settle.
4. Instrumental Methods of Analysis: Chatwal and Anand.
5. Instrumental Methods of Inorganic Analysis(ELBS):A. I. Vogel.
6. Chemical Instrumentation: A. Systematic approach-H. A. Strobel.
7. Physical Chemistry-P. W. Atkins.
8. Principles of Instrumental Analysis- D. Skoog and D. West.
9. Treatise on Analytical Chemistry: Vol. I to Vol. II-I .M. Kolthoff.
10. Computer, Fundamentals-P. K. Sinha.
11. Programming in BASIC-E. Balaguruswamy.
12. Computer programming made simple: J. Maynard.
13. The principles of ion selective electrodes and membrane transport.-W.E Mort
14. Computational Chemistry- G. Grant and W. Richards, Oxford University Press.
15. Computer for chemists by S. K. Pundir and A. Bansal

M.Sc. -I Semester-II

Inorganic Chemistry–II (HCT 2.1)

1. Chemistry of Non- transition Elements (10)

General discussion of the properties of non- transition elements, special features of the individual elements, synthesis, properties and structure of their halides and oxides, polymorphism of carbon, phosphorous, sulphur, synthesis, structure and properties of boranes, carboranes, borazines, silicates, carbides, silicones, phosphazenes, sulphur-nitrogen compounds, oxyacids of nitrogen, phosphorous, sulphur and halogen, interhalogens, pseudohalides and noble gas compounds.

2. Organometallic Chemistry of Transition Elements (08)

Synthesis, structure and bonding, organometallic reagents in organic synthesis and inhomogenous catalytic reactions (hydrogenation, hydroformylation, isomerization, Monsanto acetic acid process, synthesis gas, Wacker Process), Ziegler and Natta catalysis.

3. Metal- Ligand Equillibria in Solution (07)

Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the metal ion and ligand, chelate effect and its thermodynamic origin, determination of formation constants by pH-metry and spectrophotometry.

4. Studies and Applications of Lanthanides and Actinides (08)

Lanthanides: General introduction, separation of lanthanides, fractional crystallization, fractional precipitation, fractional thermal decomposition, ion exchange and solvent extraction, applications of lanthanides

Actinides: General introduction, separation of actinides, precipitation, solvent extraction, ion exchange, preparation of trans-uranic elements, applications of actinides

5. Nuclear Chemistry **(08)**

Radioactive decay and equilibrium,Nuclear reactions, Q values, cross sections, types of reactions, chemical effects of nuclear transformations, fission and fusion, fission products and fission yields

6. Bioinorganic Chemistry **(07)**

Role of metal ions in biological processes, molecular mechanism of ion transport across membranes, ionophores, photosynthesis PS I and PS II, nitrogen fixation, oxygen uptake proteins, cytochromes and ferrodoxines.

RECOMMENDED BOOKS

1. A. F. Wells, Structural Inorganic Chemistry – 5th Edition(1984)
2. James H. Huheey, Inorganic Chemistry- Principle, Structure and Reactivity, Harper and Row Publisher Inc., New York
3. J. D. Lee, Concise Inorganic Chemistry, ELBS with Chapman and Hall, London
4. M.C. Day and Selbin, Theoretical Inorganic Chemistry, Reinhold, EWAP
5. Jones, Elementary Coordination Chemistry
6. Morttel, Coordination Chemistry
7. T.S. Swain and D.S.T. Black, Organometallic Chemistry
8. Prakash G. More, Comprehensive Industrial Chemistry, Pragati Prakashan, Meerut
9. John Wullf, The Structure and Properties of Materials, Vol. 4, Electronic properties, Willey Eastern
10. L.V. Azoroff and J.J. Brophy, Elecronic Processes in Materials, Mc Graw Hill –I
11. F.A. Cotton and R.G. Wilkinson, Advanced Inorganic Chemistry
12. Williams and L. Jooly, Modern Inorganic Chemistry
13. Manas Chanda, Atomic Structure and Bonding

14. P.L. Pausan, Organometallic Chemistry
15. H.S. Sisler, Chemistry in non-aqueous Solvents, Reinhold Publishing Corporation, USA, 4^{th} Edition (1965)
16. H.J. Arnikar, Essentials of Nuclear Chemistry
17. Friendlander, Kennedy and Miller, Nuclear and Radiochemistry
18. Cullen, Dolphin and James, Biological Aspects of Inorganic Chemistry
19. Williams, An Introduction to Bioinorganic Chemistry
20. M.N. Hughes, Inorganic Chemistry of Biological Processes
21. Ochi, Bioinorganic Chemistry
22. O.A. Phiops, Metals and Metabolism

M.Sc.- I (Semester II)

Organic Chemistry-II(HCT 2.2)

1. **Study of following reactions with mechanism:** **(9)**

   Dieckmann, Benzoin, Favorskii reaction, Reimer-Tieman, Stobbe, Diels-Alder, Robinson annulation, Stork enamine, Barton reaction, Shapiro reaction, ene reaction and hydroboration.

2. **Reduction:** **(9)**

   Study of following reductions- Catalytic hydrogenation using homogeneous and heterogeneous catalysts. Study of following reactions: Wolff-Kishner, Meerwein Pondorff Verley, Birch, Clemmensen, Sodium borohydride, Lithium Aluminium hydride (LAH) and Sodium in alcohol.

3. **Oxidation**: **(9)**

   Application of following oxidizing agents: $KMnO_4$, chromium trioxide (Jone's reagent, PCC, PDC), Manganese dioxide, Osmium tetraoxide, Oppenauer oxidation and Lead tetra-acetate., Hydrogen peroxide, Baeyer-Villiger oxidation, Prevost-Woodward hydroxylation by silver oxide.

4. **Study of Organometallic compounds**: **(8)**

   Organo-magnesium, Organo-zinc, Organo-lithium, organo-copper and organo-tin reagents. Addition reactions: Additions to carbonyl and unsaturated carbonyl compounds, Witting reaction.

5. **Reagents in organic syntheses:** **(9)**

   Complex metal hydrides, lithium diisopropylamide–LDA, dicyclohexylcarbodiimide, PTC, crown ethers, Merrifield resin, Piterson's synthesis, 1,3-dithiane, diazomethane, DDQ.

6. **Bio-organic chemistry** **(4)**

   E lementary structure and function of biopolymers such as proteins and nucleic acids, genetic code and mechanism of enzyme action.

RECOMMONDED BOOKS

1. Modern synthetic reactions-(Benjamin) H. O. House.
2. Reagents in organic synthesis-(John Wiley) Fieser and Fieser
3. Principles of Organic synthesis-(Methuen) R. O. C. Norman
4. Hydroboration- S. C. Brown.
5. Advances in Organometallic Chemistry- (A.P.)F. C. A. Stone and R. West.
6. Organic Chemistry (Longman)Vol. I & Vol. II- Finar
7. Oxidation by-(Marcel Dekker) Augustin
8. Advanced Organic Chemistry 2nd Ed. R R. Carey and R. J. Sundburg.
9. Tetrahedron reports in Organic Chemistry- Vol.1, No. 8.
10. Organic Synthesis-(Prentice Hall)R. E. Ireland.
11. Homogeneous Hydrogenation-(J. K.) B. R. James.
12. Comprehensive Organic Chemistry- (Pargamon) Barton and Ollis.
13. Organic reactions- various volumes- R. Adams.
14. Some modern methods of Organic synthesis-(Cambridge) W. Carruthares.
15. Advanced Organic Chemistry – J. March
16. Lehninger's Principles of Biochemistry,(4th Ed.) David L. Nelson, Michael M. Cox

M.Sc.- I (Semester II)

Physical Chemistry-II(HCT 2.3)

1. Photochemistry **[20]**

Introduction, Absorption of light and nature of absorption spectra, electronic transitions, Franck–Condon principle, electronic excitation, photodissociation and Predissocition, photoreduction, photooxidation, photochemistry in environment(Green house effect).

Photophysical phenomenon. Jablonski digram. Kasha's rule, fluorescence, phosphorescence, delayed fluorescence, differences between phosphorescence and delayed fluorescence. Inter & intra molecular excitation energy transfer (EET) processes. Quenching of fluorescence and kinetics of biomolecluar quenching processes, formation of photodimer, (with suitable examples) excimer and exciplex.

2. **Electrochemistry** **[10]**

Electrical double layer and its significance (Helmholtz, Gouy-Chapmann and Stern model), Concentration cell with transference, evaluation of mean activity coefficients of ions from e.m.f. data, determination of dissociation constant of monobasic acid by e.m.f. method. Debye Huckel theory (without derivation) and limiting law.

Storage batteries: acid and alkali storage cells.

3. Chemical Kinetics **[12]**

Rate determining step, steady state approximation. fractional order kinetics, Higher order kinetics and their examples.

Reaction mechanism: Thermal decomposition of acetaldehyde, ethane, reaction between hydrogen and halogens, reaction between NO_2 and F_2, Decomposition of Ozone. Effect of ionic strength and dielectric constant of medium on the rate of ionic reactions in solution.

4. Bio-Physical Chemistry **[6]**

Biological cell (Eukaryotic and prokaryotic), structure and functions of proteins, DNA and RNA in living systems, Helix coil transition.

Bioenergetics: Standard free energy change in biochemical reactions, exergonic and enderogonic, hydrolysis of ATP, synthesis of ATP.

RECOMMENDED BOOKS

1. Photo chemistry- J.G.Calverts & J.N.Pits
2. Fundamentals of Photochemistry- K.K.Rohatgi, Mukharji
3. Photochemistry of Solutions – C. A. Parker
4. Chemical Kinetics – K.J.Laidler
5. Kinetics and Machanism - R. A. Frost and R. G. Pearson
6. Electrochemistry – S.Glasstone
7. Modern electrochemistry – Bockris & Reddy
8. Physical Chemistry – J. W. Atkins
9. Physical Chemistry – G. M. Barrow
10. Principles of Biochemistry – A. L. Lehninger
11. Biochemistry - L. Stryer, W. H. Freeman
12. Biochemistry – J. David Rawn

M.Sc. I (Semester II)

Instrumental methods of Analysis (SCT 2.1)

1. Ultraviolet and visible Spectrophotometry (8)

Introduction, Beer Lambert's law. Instrumentation, calculation of absorption maxima of dienes, dienones and polyenes, Qualitative and Quantitative applications .

2. Infra-red spectroscopy (8)

Introduction, instrutnentation, sampling technique, selection rules, types of bonds, absorption of common functional groups. Factors affecting frequencies, applications

3. Nuclear Magnetic Resonance (11)

Magnetic and nonmagnetic nuclei, Larmor frequency, absorption of radio frequency, Instrumentation (FT-NMR). Sample preparation, chemical shift, anisotropy effect, spin-spin coupling, coupling constant, applications to Simple structural problems.

4. Mass spectroscopy (9)

Principle, working of mass spectrometer (double beam). Formation of different types of ions, Mc Lafferty rearrangements, fragmentation of alkanes, alkyl aromatics, alcohols and ketones in brief simple applications, simple structural problems based on IR,UV, NMR and MS.

5. Atomic Absorption Spectroscopy (6)

Introduction, principle, difference between AAS and FES. Advantages of AAS over FES, Disadvantages of AAS, Instrumentation, Single and double beam AAS, Detection limits and sensitivity, Interference, Applications.

6 Inductively Coupled Plasma Spectroscopy (6)

Introduction, nebulization, torch, plasma, instrumentation, interferences, Applications.

RECOMMENDED BOOKS

1. Instrumental Methods of Analysis (CBS, Delhi)-Willard, Merritt, Dean & Settle.
2. Spectroscopic identification of Organic Compound (J.W.)R. M. Silverstein and G. C. Bassler.
3. Spectroscopic methods in Organic Chemistry (T. M .Hill)-D .H.Williams and I.Fleming.
4. Absorption Spectroscopy of Organic molecules (Addison-Wesley) V.M.Parikh.
5. Applications of Spectroscopy techniques in Organic Chemistry – (Wiley Eastern)- P.S.Kalsi.
6. Physical methods in Inorganic chemistry (DWAR)- R.Drago
7. Chemical Spectroscopy (Elsevier) Dudd.
8. Instrumental methods of analysis – Chatwal & Anand
9. Introduction to EPR (Hilger)- Assenliein.
10. Fundamentals of Analytical Chemistry by D.A. Skoog & D. M. West (Holt Rinehart & Winston Inc).

M. Sc. Part – I

Inorganic Chemistry Practicals

Semester I

Ore Analysis:

1. Iron Ore
2. Dolomite Ore

Alloy Analysis: (any one)

1. Brass alloy
2. Bronze alloy

Preparation and determination of purity: (any two)

1. Potassium trioxalato chromate(III)
2. Nitrito pentacyano ferrate (III) monohydrate
3. Copper acetate
4. Prussian blue
5. Manganese acetate

Note: any other relevant experiment be added

Semester II

Ore analysis: (any one)

1. Pyrolusite ore
2. Boxite ore

Alloy analysis: (any two)

1. Type metal alloy
2. Solder alloy
3. Cupro-nickel alloy

Preparation and determination of purity: (any two)

1. Sodium tetrathiocyanato diammine chromate(III)
2. Potassium hexathiocyanato chromate(III)
3. Hexa thiourea plumbus nitrate
4 Hexamine cobalt nitrate
5 Manganous ammonium phosphate

Note, (1) Any other relevant experiments may be added

RECOMMENDED BOOKS

1. Vogel's Text Book of Quantitative Inorganic Analysis.
2. W. G. Palmer, Experimental Inorganic Chemistry, Cambridge at the University Press, 1965.
3. M. A. Malati, Experimental Inorganic/Physical Chemistry, Harwood publishing Chichester.
4. A.J.E.Welch, Inorganic Preparations, George Allen & Unwin Ltd.

ORAGNIC CHEMISTY PRACTICALS

Semester –I

Qualitative analysis:

1. Separation and identification of the two component mixtures using Chemical and physical methods.(Minimum Five Mixtures)

Demonstrative Experiments:

1. Thin layer chromatography (TLC).
2. Vacuum and steam distillation techniques.
3 Extraction by Soxhlet Method

Semester –II

Preparations:

1) One stage preparations involving various types of reactions (minimum Two)

1. Aldol condensation: Dibenzal acetone from benzaldehyde.
2. Sandmeyer reaction: p- Chlorotoulene from p-toluidine.
3. Cannizzaro reaction: 4-Chlorobenzaldehyde as a substrate.

2) Two stage preparations involving various types of reactions (minimum Four)

1.Aceotophenone- Oxime- Acetanilide

2. Phthalic anhydride- o-Benzoyl benzoic acid- anthraquinone

3 Chloroenzene-2,4-dintrochlorobenzene-2,4-dinitrophenol

4 Benzoin-benzil-benzilic acid

5 Acetanilide-p-bromoacetanilide-p-bromoaniline

6 Acetanilide-p-nitroacetanilide-p-nitroaniline

B) Estimations: (minimum Two)

1) Estimation of amine by acetylation method.
2) Estimation of hydroxyl group by acetylation method
3) Estimation of an iodine value of an oil or fat.
4) Determination of percentage of Keto-enol form.

(Any other suitable experiments may be added)**.**

RECOMMENDED BOOKS

1. A text book of practical Organic Chemistry- A. I. Vogel.
2. Practical organic Chemistry- Mann and Saunders.
3. A handbook of quantitative and qualitative analysis- H. T. Clarke.
4. Organic Synthesis Collective Volumes by Blat.
5. Systematic Lab Experiments in Organic Chemistry by Arun Sethi
6. Advanced practical chemistry by Jagdamba Singh

M.Sc. I Semester-I

Physical Chemistry Practicals

NON-INSTRUMENTAL

Kinetics

1. To investigate the auto-catalytic reaction between potassium permanganate and oxalic acid.
2. Iodonation of acetone
3. Determination of energy of activation of acid catalyzed hydrolysis of an ester.

Viscosity

1. Determine the molecular weight of PVA by viscosity measurements.

Adsorption

1. Acetic acid on activated animal charcoal

Phase Equilibria :-

1. Three component system: Acetic acid, chloroform, water
2. To determine the CST of phenol-water system in presence of 1% NaCl

Surface Tension:

1. To determine the surface tension of a liquid by stalagmometer (drop number method)

INSTRUMENTAL

Refractometry

1. Determine the structure of given Organic Liquids

pH metry:

1. Determination of pKa of dibasic acid (Oxalic acid)
2. Determination of hydrolysis constant of aniline hydrochloride

Conductometry

1. Titration of $ZnSO_4$ / $MgSO_4$ against $BaCl_2$ and $Ba(CH_3COO)_2$ and calculation of amount of Sulphate Present .
2. Conductometric estimation of NH_4Cl with NaOH solution.

Potentiometry

1. To determine the basicity and pKa value of organic acids by potentimetric method. (Orthophosphoric acid)
2. Determine the solubility and solubility product of sparingly soluble salts.

Semester-II

NON-INSTRUMENTAL

Kinetics

1. Determination of order of reaction by differential method
2. Comparison of acid strength by hydrolysis of ester

Viscosity

1. Determine the radius of molecule by viscosity measurements. (glycerol / sucrose)

Adsorption

1. Oxalic acid on activated animal charcoal

Phase Equilibria :-

1. Three component system: Benzene, ethyl alcohol and water
2. To determine the CST of phenol-water system in presence of 0.5% naphthalene (or 1% succinic acid)

Surface Tension:

1. To determine the atomic parachor of C, H and Cl by surface tension measurements.

INSTRUMENTAL

Refractometry

1. To determine the electron polarization and electron polarizability of a liquid.

pH metry:

1. Determination of pKa of acid (Succinic acid)
2. Determination of hydrolysis constant of aniline hydrochloride

Conductometry

1. Solubility and solubility product of spranigly soluble salts.
2. Titration of a mixture of HCl, CH_3COOH and $CuSO_4$ against alkali.

Potentiometer

1. Estimate the amount of halides present in the given mixture by titrating with $AgNO_3$ solution.
2. Titration of mixture of acids with base.

Polarimetry

1. To determine the percentage of two optically active substances (d-sucrose and d-tartaric acid) in a given solution.

Each candidate has to perform minimum 10 experiments (at least one from each technique) in each semester. Any other relevant experiments may be added.

RECOMMENDED BOOKS

1. Findlay's Practical Physical Chemistry by J.A. Kitchnar
2. Text-book of Quantitative Inorganic Analysis including elementary Instrumental Analysis- A.I.Vogel, Revised by J.Bassott, R.C.Banney
3. Experimental Physical Chemistry – F.Daniels & J.Williams
4. Experimental Physical Chemistry – R.C.Das & B.Behra
5. Systematic experimental Physical Chemistry by- Rajbhoj and Chondhekar.
6. Experimental physical Chemistry- V.D. Athawale and P. Mathur
7. Advanced practical physical Chemistry- J. B. Yadav
8. Advanced physical Chemistry Experiments- Gurtu and Gurtu

Analytical Chemistry Practicals

Semester I

A) Inorganic Analytical Chemistry

1. Determination of calcium from given drug sample.
2. Determination of hardness, alkalinity and salinity of water.
3. Separation and estimation of chloride and bromide on anion exchanger
4 To determine the amount of Cu in brass metal alloy titrimetrically
5 Separation and estimation of Fe and Al on cation exchanger

B) Organic Analytical Chemistry

1. Analysis of Pharmaceutical tablets.
2. To verify the Beer-Lambert's Law and determine the concentration of given dye solution colorimetrically.
3. To determine the acid value of given oil.
4 Separation of mixture of o-and p-nitroanilines on an alumina column..
5 Determination of uric acid / createmins in urine.
6 Analysis of pharmaceutical tablet lbrufen
7 Estimate amount of endosulphon.

C) Analytical Physical Chemistry

1. To Verify Beer –Lambert's Law for solution of $KMnO_4$ in water and in acid medium Colorimetrically
2. To determine the solubility of calcium Oxalate in presence of KCI (Ionic Strength Effect)
3. To determine the solubility of calcium Oxalate in presence of HCI (H^+ ion Effect)
4. To determine the pKa value of dibasic acid (malonic) by pHmetery.
5. To determine the amount of carbonate & bicarbonate by potentiometrically.
6. Estimate the concentration of H_2SO_4, CH_3COOH and $CuSO_4$ by conductometric titration with NaOH solution.

Semester II

A) Inorganic Analytical Chemistry

1. Determination of sodium from the fertilizer sample using cation exchange chromatography.
2. Determination of Zn and Cd from the given solution by using anion exchanger resin
3 Separation and estimation of Ni and Co on anion exchanger
4. Estimation of Pb and Sn in solder alloy
5. Determination of Mo, Fe, by solvent extraction using isopropyl alcohol as solvent.

B) Organic Analytical Chemistry

1. To estimate the amount of D-glucose colorimetrically
2. To separate a mixture of 2,4-dinitrophenyl hydrazones by adsorption chromatographic technique.
3. Analysis of pharmaceutical tablet Analgin.
4. Caffeine in Tea Powder.
5. Determination of percentage purity of given olefinic compound by bromination method.
6. Colorimetric estimation of drugs.

D) Analytical Physical Chemistry

1. To Verify Beer –Lambert's Law for $K_2Cr_2O_7$ in water and in acid medium colorimetrically
2. To determine the solubility of lead iodide in different concentrations of KCI (Ionic Strength Effect)
3. To determine the solubility of lead iodide in different concentrations of KNO_3 (Ionic Strength Effect)
4. To determine the amount of carbonate & bicarbonate by pHmetry
5. To determine the concentration of vinegar conductometrically.
6. To estimate the amount of D-glucose in given solution polarimetrically.

Minimum three experiments from each section may be conducted during each semester. However, the total number of experiments conducted should be commensurate with the facilities and time available.

Any other relevant experiments may be added.

RECOMMENDED BOOKS

1. A text book of quantitative inorganic analysis, A.I. Vogel
2. Standard methods of chemical analysis, F. J. Welcher
3. Experimental Inorganic Chemistry, W. G. Palmer
4. Manual on water and waste-water analysis, NEERI, Nagpur; D.S. Ramteke and C.A. Moghe

5 .Inorganic synthesis, King

6. Synthetic inorganic chemistry, W. L. Jolly

7. EDTA titrations, F. Laschka

8. Experimental physical Chemistry- V.D. Athawale and P. Mathur

9. Advanced practical physical Chemistry- J. B. Yadav

10. Advanced physical Chemistry Experiments- Gurtu and Gurtu

11. Practical organic Chemistry by F. G. Mann, B. C. Saunders

12. Quantitative organic analysis, A.I. Vogel