PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR

SALEM – 636011

DEGREE OF MASTER OF SCIENCE

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR

M.SC. ANALYTICAL CHEMSITRY

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to Periyar University from 2017-2018 onwards)

REGULATIONS

1. OBJECTIVES OF THE COURSE:

The objectives of this course are the following:

(a) To impart knowledge in advanced concepts and applications in various fields of Chemistry and to acquire deep knowledge in the study of Analytical Chemistry

(b) To provide wide choice of elective subjects with updated and new areas in various branches of Chemistry to meet the needs of all students.

2. COMMENCEMENT OF THIS REGULATION:

These regulations shall take effect from the academic year 2017-2018, that is, for students who are admitted to the first year of the course during the academic year 2017-2018 and thereafter.

3. ELIGIBILITY FOR ADMISSION:

A candidate who has passed B.Sc., Chemistry degree of this University or any other University accepted by the Syndicate equivalent thereto, subject to such condition as may be prescribed therefore are eligible for admission to M.Sc., Degree Programme and shall be permitted to appear and qualify for the Master of Science (M.Sc.) Degree Examination in Analytical Chemistry of this University.

4. DURATION OF THE COURSE:

The programme for the degree of Master of Science in Chemistry shall consist of two Academic years divided into four semesters.

5. EXAMINATIONS:

The examination shall be of three hours duration for each course at the end of each semester. The candidate failing in any subject(s) will be permitted to appear in the subsequent examination.

The practical / project should be an individual work. The University examination for practical / project work will be conducted by the internal and external examiners jointly at the end of every year.

COURSE OF STUDY AND SCHEME OF EXAMINATION

Course (Paper)	Paper Code	Subject Title	Hours/ Week	Work Load per sem (Hours)	Credit	Exam Hours	Marks		Total
							Internal	External	
SEMESTER I									
Core I		Organic Chemistry - I	5	75	5	3	25	75	100
Core II		Inorganic Chemistry - I	5	75	5	3	25	75	100
Core III		Physical Chemistry - I	5	75	5	3	25	75	100
Elective I		Polymer Chemistry / Conducting Polymers	5	75	4	3	25	75	100
Core Practical I		Organic Chemistry Practical - I	4	50	-	-	-	-	-
Core Practical III		Inorganic Chemistry Practical - I	3	45	-	-	-	-	-
Core Paper III		Physical Chemistry Practical - I	3	45	-	-	-	-	-
		Total	**30**	**450**	**19**				**400**
SEMESTER II									
Core IV		Organic Chemistry - II	5	75	5	3	25	75	100
Core V		Inorganic Chemistry - II	5	75	5	3	25	75	100
Core VI		Physical Chemistry - II	5	75	5	3	25	75	100
EDC		Extra Disciplinary course	4	60	4	3	25	75	100
Core Practical I		Organic Chemistry Practical - I	3	45	3	6	40	60	100
Core Practical II		Inorganic Chemistry Practical - I	3	45	3	6	40	60	100
Core Practical III		Physical Chemistry Practical - I	3	45	3	6	40	60	100
Common Paper		Human Rights	2	30	2	3	25	75	100
		Total	**30**	**450**	**30**				**800**

Course (Paper)	Paper Code	Course Title	Hours/ Week	Work Load per sem (Hours)	Credit	Exam Hours	Marks		Total
							Internal	External	
SEMESTER III									
Core VII		Analytical Chemistry - I	5	75	5	3	25	75	100
Core VIII		Analytical Chemistry - II	5	75	5	3	25	75	100
Elective II		Data Treatment & Titrimetric analysis	5	75	4	3	25	75	100
Elective III		Optical methods and Thermal Analysis	5	75	4	3	25	75	100
Core I Practical IV		Analysis Chemistry Practical - I	4	60	-	-	-	-	-
Core Practical V		Analysis Chemistry Practical - II	3	45	-	-	-	-	-
Core Practical VI		Analysis Chemistry Practical - III	3	45	-	-	-	-	-
		Total	**30**	**450**	**18**				**400**
SEMESTER IV									
Core IX		Analytical Chemistry - III	5	75	5	3	25	75	100
Elective IV		Analysis of materials	5	75	4	3	25	75	100
Core Practical IV		Analytical Chemistry Practical - I	3	45	3	6	40	60	100
Core Practical V		Analytical Chemistry Practical -II	3	45	3	6	40	60	100
Core Practical VI		Analytical Chemistry Practical - III	3	45	3	6	40	60	100
Project		Dissertation /Project work	11	165	7	-	-	-	200
		Total	**30**	**450**	**25**				**700**
		Grand Total	**120**	**1800**	**92**	**-**	**-**	**-**	**2300**

NOTE:I

Core Papers	: 9
Core Practicals	: 6
Elective papers	: 4
EDC	: 1
Human Rights	: 1
Project	: 1

NOTE : II

Distribution of Marks
Theory

University Examination (External) : 75 marks
Internal Assessment : 25 marks

Distribution of Internal Assessment mark

Test	: 10 marks
Attendance	: 5 marks
Assignment	: 5 marks
Seminar	: 5 marks
Total	25 marks

Passing Minimum : Internal Assessment : 50% - 12 marks
Passing Minimum : External Assessment : 50% - 38 marks
Total Passing Minimum - 50 marks

PRACTICALS

University Examination (External) : 60 marks
Internal Assessment : 40 marks

Calculation of Internal Assessment mark

Number of Experiments	:	10 marks
Experimental skill	:	10 marks
Test	:	20 marks
Total	:	40 marks

Passing Minimum : Internal Assessment : 50% - 20 marks
Passing Minimum : External Assessment : 50% - 30 marks
Total Passing Minimum - 50 marks

Everything should be supported by proper record
separate passing minimum is necessary for Internal and External

QUESTION PAPER PATTERN

Theory

Time: 3 Hours Max. marks : 75

Part - A : 5X5 = 25

(Answer all questions)

(one question from each unit with internal choice)

Part - B : 5X10 = 50

(Answer all questions)

(one question from each unit with internal choice)

Practical

Distribution of marks for practical

Experiment	:	45 marks
Viva-voce in practical	:	10 marks
Record	:	5 marks
Total	:	60 marks
Duration	:	6 Hours

Project

Dissertation / Project	:	150 marks
Viva - voce	:	50 marks
Total	:	200 marks

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER I
CORE I - ORGANIC CHEMISTRY – I
(75 Hours)

UNIT I Stereochemistry (15 Hours)

Fischer, Newman and Sawhorse projections and their interconversion. Axial chirality – biphenyls, allenes and spiranes – R and S notations. Chirality due to helical shape, planar chirality - Cyclophanes, ansa compounds and trans cyclooctene. Stereospecific and stereoselective synthesis with suitable examples, asymmetric synthesis – Crams rule. Homotopic, enantiotopic, diastereotopic H atoms, groups in organic molecules.

Conformational analysis and stereochemical features of disubstituted cyclohexanes (1,2 ; 1,3 ; 1,4 dialkyl cyclo hexanes), conformation and stereochemistry of cis and trans decalins.

UNIT II Reaction intermediates, Structure and Reactivity (15 Hours)

Reaction intermediates : Formation, stability and structure of carbonium ions, carbanions, carbenes, nitrenes and free radicals.

Free radical reactions : Sandmeyer reaction, Gomberg-Bachmann reaction, Pschorr reaction and Ullmann reaction, Hunsdiecker reaction.

Effect of structure on reactivity – resonance and fields effects, steric effects, quantitative treatment – the Hammett equation and linear free energy relationship, substituent and reaction constant, Taft equation. Thermodynamic and kinetic requirements for reactions, thermodynamically and kinetically controlled reactions, Hammonds postulate, transition states and intermediates, Kinetic & non kinetic methods of determining mechanisms, identification of products and determination of the presence of an intermediate, isotopic labeling, kinetic isotope effects.

UNIT III Aliphatic Nucleophilic Substitution Reactions (15 Hours)

The SN1, SN2 & SNi mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, anchimeric assistance. Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon.

Reactivity effects of substrates structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile, regioselectivity. Williamson reaction, Von-braun reaction, hydrolysis of esters, Claisen and Dieckmann condensation.

UNIT IV

Aromatic electrophilc and nucleophilic substitution reactions (15 Hours)

The arenium ion mechanism, typical reactions like nitration, sulphonation, halogenation, Friedel – Crafts alkylation, acylation and diazonium coupling, electrophilic substitution on monosubstituted benzene, orientation and reactivity – ortho, meta and para directing groups, ortho-para ratio, ipso attack, Gatterman, Gatterman- Koch, Vilsmeir, Houben Hoesch reaction.

Aromatic nucleophilic substitution reactions, the SNAr mechanism, the aryl cation mechanism, the benzyne intermediate mechanism, Ziegler alkylation, Chichibabin reaction.

UNIT – V Alkaloids, Flavones and Isoflavones (15 Hours)

Synthesis and Structural elucidation of Quinine, Papaverine, Morphine and Reserpine.

Synthesis and structural elucidation of flavones, isoflavones and anthocyanins.

TEXT BOOKS

1. Jerry March, Advanced Organic Chemistry-Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons (1992)
2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc., 1996.
3. P.S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers, 2002.
4. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata McGraw-Hill Publishing Company, 1995.
5. P.S. Kalsi, Stereochemistry – Conformation and Mechanism, 6th Edition, Wiley Eastern Limited, 2005.
6. I.L. Finar, Organic Chemistry, Volume II, Fifth Edition, First Indian reprint, Pearson Education Asia Pte. Ltd., (2000)

REFERENCE BOOKS

1. P.S. Kalsi, Stereochemistry and Mechanism through solved problems, Second Edition, New Age International Publishers, 1994.
2. D. Nasipuri, Stereochemistry of Organic Compounds, 2nd Edition, New Age International Publishers, 1994.
3. S.M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, 1st Edition, Macmillan, 1976.
4. R.T. Morrison and R.N. Boyd, Organic Chemistry, 6th Edition, Prentice-Hall, 1992.
5. R.O.C. Norman, Principles of Organic Synthesis, Second Edition, Chapman and Hall, 1978.
6. R.M. Acheson, Introduction to Chemistry of Heterocyclic Compounds, 2nd Edition, Interscience Publishers, 1967.
7. J.A. Joule and G.F. Smith, Heterocyclic Chemistry, Van Notrand Reishord Co., London, 1978.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER I
CORE II - INORGANIC CHEMISTRY-I
(75 Hours)

UNIT I Structure and Bonding **(15 Hours)**

Van der Waals bonding, Hydrogen bonding; HSAB concept; polyacids - Isopolyacids of V, Cr, Mo and W; Heteropolyacids of Mo and W (only structural aspects). Inorganic polymers - silicates - structure, properties, correlation and application; Molecular sieves; polysulphur nitrogen compounds and polyorganophosphazenes.

UNIT II Boron Compounds and Clusters(**(15 Hours)**

Boron hydrides, polyhedral boranes, hydroborate ions- a general study of preparation, properties and structure; Carboranes - types such as closo and nido, preparation, properties and structure; Metallo carboranes - a general study; Metal clusters-chemistry of low molecularity metal clusters only, multiple metal-metal bonds.

UNIT III Nuclear Chemistry I **(15 Hours)**

Nuclear structure - stability of nuclei, packing fraction, even-odd nature of nucleons, n/p ratio, nuclear potential, binding energy and exchange forces; shell model and liquid drop model; Decay of radio nuclei - rate of decay; determination of half-life period; Modes of decay - alpha, beta, gamma and orbital electron capture; nuclear isomerism; internal conversions; Q value; nuclear cross section; threshold energy and excitation functions.

UNIT IV Nuclear Chemistry II **(15 Hours)**

Different type of nuclear reactions with natural and accelerated particles-transmutation, stripping and pick-up, spallation, fragmentation, fission; Characteristic of fission reaction, product distribution and theories of fission; fissile and fertile isotopes - U235, U238, Th232 and Pu239; atom bomb; nuclear fusion - steller energy; Synthesis of new elements; principles underlying the usage of radioisotopes in analysis – agriculture, industry, medicine, mechanism of chemical reactions; uses of radioisotopes in analytical chemistry; isotopic dilution analysis; neutron activation analysis and dating methods.

UNIT V Experimental Methods **(15 Hours)**

Cloud chamber, nuclear emulsion, bubble chamber, proportional counters, G.M. Counter, Scintillation counters and Cherenkov counters. Particle accelerators - Linear accelerator, Cyclotron, Synchrotron, Betatron and Bevatron.

TEXT BOOKS

1. H.J. Emelius and Sharpe, Modern aspects of Inorganic chemistry, Universal book Stall, New Delhi, 1989.
2. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry- Principles of structure and reactivity, 4th edition, Pearson-Education, 2002.
3. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 5th edition, 1988.
4. S. Glasstone, Source book of atomic Energy, Van Nonstrand Co., 1969.
5. H.J. Arniker, Essentials of nuclear chemistry, 2nd edition Wiley eastern Co.,1987.

REFERENCE BOOKS

1. E.L. Mutteri, Polyhedral boranes, Acadamic press, NY, 1975.
2. N.H. Ray, Inorganic polymers, Academic press, NY, 1975.
3. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, WB Saunders Co. USA 1977.
4. G.S. Manku, Inorganic Chemistry, TMH Co., 1984.
5. A.K. Srivatsava and P.C. Jain, Elements of Nuclear Chemistry, S. Chand and Co., 1989.
6. G. Friedlander, J.W. Kennedy and J.M. Miller, Nuclear and Radiochemistry, Wiley, 1964.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER I
CORE III - PHYSICAL CHEMISTRY – I

(75 Hours)

UNIT I Group theory-I **(15 Hours)**

Symmetry elements; symmetry operations; point groups - identification and determination; comparison of molecular and crystallographic symmetry; reducible and irreducible representations; direct product representation; orthogonality theorem and its consequences; character table. Hybrid orbitals in non-linear molecules – Examples: H2O, NH3, BF3, CH4 and XeF4. Determination of representations of vibrational modes in non-linear molecules such as water, ammonia, BF3, CH4 and XeF4.

UNIT II Thermodynamics **(15 Hours)**

First law of thermodynamics; temperature dependence of enthalpies; Second law of thermodynamics; Gibbs-Helmholtz equation; Third law of thermodynamics. Free energy and entropy of mixing; chemical potential, partial molar volume and partial molar heat content. Variation of chemical potential with temperature and pressure-Gibbs-Duhem equation. Thermodynamics of ideal and real gases-fugacity, activity and activity coefficient.

UNIT III Statistical thermodynamics **(15 Hours)**

Thermodynamic probability and entropy; Boltzman distribution law; Maxwel-Boltzman, Bose-Einstein and Fermi-Dirac statistics; vibrational, rotational and electronic partition functions; calculation of thermodynamic functions and equilibrium constants; Theories of specific heats of solids; postulates and methodologies of non-equilibrium thermodynamics; linear laws; Gibbs equation;

UNIT-IV Non-equilibrium thermodynamics **(15 Hours)**

Thermodynamic criteria for non-equilibrium states; entropy production and entropy flow; entropy balance equations for different irreversible processes (heat flow, chemical reaction etc.); Non-equilibrium stationary states; microscopic reversibility; Onsager reciprocal theory.

UNIT V Electrochemistry **(15 Hours)**

Mean ionic activity and activity coefficient of electrolytes in solutions; ideal and non-ideal solutions; excess functions; Hydration number; Debye-Huckel treatment of dilute electrolyte solutions; Debye-Huckel limiting law; Electrochemical cell reactions - Electrode-electrolyte interface; electrokinetic phenomina; electrode kinetics; Batteries-primary and secondary; fuel cells; corrosion and its prevention.

TEXT BOOKS

1. V. Ramakrishnan and M.S. Gopinathan, Group theory in Chemistry, Vishal Publications,1988.
2. J. Rajaram and J.C. Kuriacose, Thermodynamics for Students of Chemistry, Lal Nagin Chand, New Delhi, 1986.
3. M.C. Gupta, Statistical Thermodynamics, Wiley Eastern, New Delhi,1990.
4. J. Rajaram and J.C. Kuriacose, Irreversible Thermodynamics, Lal Nagin Chand, New Delhi, 1989.
5. S.Glasstone, Introduction to Electrochemistry, Affiliated East west Press, New Delhi 1960.

REFERENCE BOOKS

1. F.A. Cotton, Chemical Application of Group Theory, John Wiley and Sons Inc. New York,1971.
2. K.V. Raman, Group theory and its applications to Chemistry, Tata McGraw-Hill Publishing Company,1990.
3. R.P.H.Gasser and W.G.Richards, Introduction to Statistical Thermodynamics, World Scientific, Singapore, 1995.
4. D.R. Crow, Principles and application of Electrochemistry, Chapman and Hall, 1991.
5. J.O.M. Bockris and A.K.N. Reddy, Electrochemistry, Vols. 1 and 2, Plenum, New York, 1977.
6. P.H.Rieger, Electrochemistry, Chapman and Hall, New York, 1994.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER I
ELECTIVE I
PAPER I - POLYMER CHEMISTRY
(75 Hours)

UNIT I Basic Concepts **(15 Hours)**

Monomers, repeat units, degree of polymerization, Linear, branched and network Polymers. Condensation Polymerization : Mechanism of stepwise polymerization. Kinetics and statistics of linear stepwise polymerization. Addition polymerization : Free radical, cationic and anionic polymerization. Polymerization conditions. Polymerization in homogeneous and heterogeneous systems.

UNIT II Co-ordination Polymerization **(15 Hours)**

Kinetics, mono and bimetallic mechanism of co-ordination polymers. Zeigler Natta catalyst, co-polymerization: Block and graft co-polymers, kinetics of copolymerization. Types of co-polymerization. Reactivity ratio.

UNIT III Molecular Weight and Properties **(15 Hours)**

Polydispersion – average molecular weight concept, number, weight and viscosity average molecular weights. Measurement of molecular weights. Viscosity, light scattering, osmotic and ultracentrifugation methods. Polymer structure and physical properties – crystalline melting point Tm. The glass transition temperature. Determination of Tg. Relationship between Tm and Tg.

UNIT IV Polymer Processing **(15 Hours)**

Plastics, elastomers and fibres. Compounding, processing techniques: calendering, die casting, rotational casting, film casting, injection moulding, blow moulding extrusion, moulding, thermoforming, foaming, reinforcing and fibre spinning.

UNIT – V Properties of Commercial Polymers **(15 Hours)**

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers, Fire retarding polymers and electrically conducting polymers. Biomedical polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

TEXT BOOKS

1. F.W. Billmeyer, TextBook of Polymer Science, 3rd Edition, J.Wiley, 2003.

2. V. R. Gowariker, N.V. Viswanathan and J. Sreedhar, Polymer Science, New Age Int., 1986.

REFERENCE BOOKS

1. H.R. Alcock and F.W. Lamber, Contemporary Polymer Chemistry, Prentice Hall, 1981.

2. P.J. Flory, Principles of Polymer Chemistry, Cornell University press, New York, 1953.

3. G. Odian, Principles of Polymerization, 2nd Edition, John Wiley & Sons, New York, 1981.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER I
ELECTIVE I
PAPER II - CONDUCTING POLYMERS
(75 Hours)

UNIT I Basic Concepts and Synthetic methods (15 Hours)

Basics of conducting polymers - Organic - conjugated unsaturated hydrocarbons- Chemical Synthesis of conducting polymers – Other synthetic methods

UNIT II Electrochemical Synthesis (15 Hours)

Electrochemical synthesis of conducting polymers – monomers, electrolytic condition, electrodes and mechanism; Electrochemical synthesis of derivatives of poly pyrrole, polythiophene, polyazulene, polycarbazole, polyindole, polyaniline and polyphenylene.

UNIT III Semiconducting and Metallic Polymers (15 Hours)

Structural basis for semiconducting and metallic polymers – introduction; Organic meta polymers - Synthetic route, isomers and electronic structure (polymers like polyacetylene, poly(p-phenylene), polypyrrole, polythiophene, etc.,).

UNIT IV Doping (15 Hours)

Electrochemical doping; deadline to the development of conducting polymers; role of reduction and oxidation potential in doping; polyacetylene as electrode materials.

UNIT V Catalytic Conducting Polymers (15 Hours)

Catalytic properties of conducting polymers; catalysis of electron donor-acceptor complexes; electrocatalysis by semiconducting polymers.

TEXT BOOKS

1) Terje A. Skotheim, Ronald L. Elsenbaumer, John R. Reynolds, Handbook of Conducting Polymers, Second Edition, Marcel Dekkar, 1995.
2) Hari Singh Nalwa (Edn), Handbook of Organic Conductive Molecules and Polymers, Four Volumes, Wiley, 1997

REFERENCE BOOKS

1) Jean-Pierre Farges, Organic Conductors, Marcel Dekkar, 1994
2) David B Cotts, Z Reyes, Electrically Conductive Organic Polymers for Advanced Applications, William Andrew Inc,1987
3) Larry Rupprecht, Conductive Polymers and Plastics, William Andrew Inc, 1999.
4) Raymond B Seymour, New Concepts in Polymer Science, Polymeric Composites, VSP, 1990.
5) Wallace Gordon, Gordon G Wallace, Geoffrey M Spinks, Conductive Electroactive Polymers, CRC Press, 2002

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER II
CORE IV - ORGANIC CHEMISTRY – II
[75 Hours]

UNIT I Elimination Reactions **(15 Hours)**

E1, E2, E1cB mechanisms, Orientation of the double bond- Hofmann and Saytzeff rule, competition between elimination and substitution, dehydration and dehydrohalogenation reactions, stereochemistry of E2 eliminations in cyclohexane ring systems, mechanism of pyrolytic eliminations, Chugaev reaction and Cope elimination.

UNIT II Aromaticity **(15 Hours)**

Aromatic character: Five-, six-, seven-, and eight-membered rings - other systems with aromatic sextets - Huckel's theory of aromaticity, concept of homoaromaticity and antiaromaticity.

Electron occupancy in MO's and aromaticity - NMR concept of aromaticity and antiaromaticity, systems with 2,4,8 and 10 electrons, systems of more than 10 electrons (annulenes), Mobius aromaticity.

Bonding properties of systems with (4n+2)π-electrons and 4nπ - electrons, alternant and non-alternant hydrocarbons (azulene type) - aromaticity in heteroaromatic molecules, sydnones and fullerenes.

UNIT III Organic Photochemistry **(15 Hours)**

Photochemical reactions : Fate of excited molecules, Jablonski diagram, Norrish Type I and Norrish Type II reactions, photoreduction of ketone, photoaddition reactions, Paterno Buchi reaction, di –pi methane rearrangement, photochemistry of arenes, Photooxidation (Formation of peroxy compounds), Photoisomerization (Cis – trans isomerization), Photo addition of olefins and amines to aromatic compounds, Photo rearrangements: Photo – Fries rearrangement and Photo rearrangement of 2,5 – Cyclohexadienones.

UNIT IV Pericyclic Reactions **(15 Hours)**

Pericyclic reactions, classification, orbital symmetry, Woodward Hofmann rules, selection rules and stereochemistry of electrocyclic reactions, cycloaddition and sigmatropic shifts, analysis by correlaton diagram method and Frontier molecular orbital method, Sommelet-Hauser, Cope and Claisen rearrangements.

UNIT V Reagents in Organic Synthesis **(15 Hours)**

Reagents and their uses: DCC, DDQ, DBU, DIBAL, 9BBN, NBS, 1,3 – dithiane (umpolung), n-Butyl Lithium, trimethyl silyl iodide, trimethyl silyl chloride, Lithium dimethyl cuprate, Baker's yeast and Gilman's reagent.

TEXT BOOKS

1. Jerry March, Advanced Organic Chemistry-Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons (1992)

2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc., 1996.

3. P.S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers, 2002.

4. P.S. Kalsi, Stereochemistry – Conformation and Mechanism, 6th Edition, Wiley Eastern Limited, 2005.

5. I.L. Finar, Organic Chemistry, Volume II, Fifth Edition, First Indian reprint, Pearson Education Asia Pte. Ltd., (2000)

REFERENCE BOOKS

1. S. H. Pine, J.B. Hendrickson, D.J. Cram and G.S. Hammond, Organic Chemistry, IV Edn., McGraw Hill Company, 1980.

2. S.M. Mukherji and S. P. Singh, Reaction Mechanism in Organic Chemistry, 1st Edition, Macmillan, 1976.

3. R.T. Morrison and R.N. Boyd, Organic Chemistry, Prentice-Hall, 1992.

4. R.O.C. Norman, Principles of Organic Synthesis, Second Edition, Chapman and Hall, 1978.

5. S.M. Mukherji and S.P. Singh, Reaction Mechanism in Organic Chemistry, III Edn. 1984. MacMillan.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER II
CORE V - INORGANIC CHEMISTRY -II
[75 Hours]

UNIT I Metal-Ligand Bonding (15 Hours)

18 Electron rule; EAN rule, theories of coordination compounds - valence bond theory, crystal field theory - splitting of d-orbitals in different symmetries, crystal field stabilization energy, factors affecting the magnitude of 10 Dq, evidence for crystal field stabilization, spectrochemical series, site selection in spinels, tetragonal distortion from octahedral symmetry, Jahn-Teller distortion; Molecular Orbital Theory - octahedral complexes, tetrahedral and square planar complexes, pi bonding and molecular orbital theory, experimental evidence for pi-bonding.

UNIT II Electronic Spectra and Magnetic Properties (15 Hours)

Term states of dn ions - microstates and their classifications, electronic spectra of coordination compounds - selection rules, band intensities and band widths; energy level diagrams of Orgel and Tanabe - Sugano diagram; spectra of Ti3+, V3+, Ni2+, Cr3+, Co2+, Cr2+ and Fe2+; calculation of 10Dq and B for V3+ (oct) and Ni2+ (oct) complexes.

Magnetic properties of coordination compounds - change in magnetic properties of complexes in terms of spin-orbit coupling; spin only moments of dn systems; temperature independent paramagnetism; spin cross over phenomena.

UNIT III Structure of Coordination Complexes (15 Hours)

Structure of coordination compounds with reference to the existence of various coordination numbers - complexes with coordination number two, complexes with coordination number three, complexes with coordination number four - tetrahedral and square planar complexes, complexes with coordination number five - regular trigonal bipyramidal and square pyramidal; site preference in trigonal bipyramidal complexes, site preference in square planar complexes; coordination number six - distortion from perfect octahedral symmetry, trigonal prism; stereoselectivity and conformation of chelate rings; coordination number seven and eight.

UNIT IV Stability and Stereochemical Aspects (15 Hours)

Stability of complexes - thermodynamic aspects of complex formation, factors affecting stability, stability correlations, statistical and chelate effects; Determination of stability constants - polarographic, photometric and potentiometric methods.

Stereochemical aspects - stereoisomerism in inorganic complexes, isomerism arising out of ligand distribution and ligand conformation, chirality.

Macrocyclic ligand types - porphyrins, corrins, Schiff bases, crown ethers, cryptates and catenands. (simple complexes).

UNIT V Reaction Mechanism of transition metal complexes (15 Hours)

Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitutions, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reactions. Redox reactions, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

TEXT BOOKS

1. J.E. Huheey, E.A. Keiter and R.L. Keiter, Inorganic Chemistry- Principles of structure and reactivity, 4th edition, Pearson-Education, 2002.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern 1988.
3. S.F.A. Kettle, Co-ordination compounds, ELBS, 1973.
4. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., NY. 1974.
5. K.F. Purcell and J.C. Kotz, Inorganic Chemistry, WB. Sanders Co., USA 1977.
6. D. F. Shriver, P. W. Atkins and C.H. Longford, Inorganic Chemistry, ELBS, 2nd edition, 1994.
7. R.B. Heslop and K. Jones, Inorganic Chemistry, Elsevier, 1976.

REFERENCE BOOKS

1. D. Bannerjea, Co-ordination Chemistry, Tata-McGraw Hill, 1993.
2. M.L. Tobe, Inorganic Reaction Mechanism, Nelson, 1972.
3. K. Burger, Coordination Chemistry Experimental Methods, Butterworths, 1973.
4. B.N. Figgis, Introduction to Ligand Fields, Wiley Eastern Ltd, New Delhi, 1976.
5. F. Basolo and R.G. Pearson, Mechanism of Inorganic Reactions, Wiley Eastern, 1967.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER II
CORE VI - PHYSICAL CHEMISTRY – II
[75 Hours]

UNIT I Quantum Chemistry-I **(15 Hours)**

Planck's Quantum theory - wave particle duality, Uncertainity principle; Operators and commutation relations- Linear and Hermitian operators. Postulates of quantum mechanics; The Schrodinger equation-Particle in a box (one, two and three dimensional systems).

UNIT II Quantum chemistry –II **(15 Hours)**

Applications of quantum mechanics - harmonic oscillator, rigid rotator, hydrogen atom; Approximation methods-variation and perturbation methods, application to helium atom.

UNIT III Quantum Chemistry-III **(15 Hours)**

Born-Oppenheimer approximation- VB and MO treatments of hydrogen molecule; MO for polyatomic molecules; Concept of hybridization-sp, sp2 and sp3; Huckel pi-electron theory and its applications to ethylene, butadiene and benzene; Idea of self consistent fields.

UNIT-IV Surface Chemistry **(15 Hours)**

Surface tension; solid-liquid interfaces; contact angle and wetting; Solid-gas interface; Adsorption of gases on solids-Freundlich, Gibbs, Langmuir, Temkin and BET adsorption isotherm; Surface area determination; electrical phenomena at interfaces; micelles and reverse micelles - solublization and microemulsion.

UNIT-V Chemical Kinetics **(15 Hours)**

Methods of determining rate laws; Theories of reaction rates - simple collision theory, ARR theory; treatment of unimolecular reactions (Lindemann-Hinselwood and Rice-Ramsperger-Kassel-Marcus[RRKM] theories); termolecular reactions; chain reactions; explosive reactions; Arrhenius and Eyring equations; Reaction rates in solution; salt effect and solvent dielectric constant; Homogeneous and heterogeneous catalysis; Enzyme catalysis- Michaelis-Menton kinetics; Fast reactions- study of kinetics by stopped flow technique, relaxation method, flash photolysis and magnetic resonance method.

TEXT BOOKS

1. D.A. McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, California, 1983.
2. J. Rajaram and J.C. Kuriacose, Kinetics and Mechanism of Chemical Transformations, MacMillan India Ltd. 1993.
3. P.W.Atkins, Physical Chemistry, Oxford University Press, Oxford, 1990.
4. D.A. McQuarrie, Text Book of Physical Chemistry, University Science Books, Mill Valley, California, 1983.
5. R.A. Alberty and R.J.Silbey, Physical Chemistry, John Wiley and Sons, New York, 1992
6. A.W.Adamson, Physical Chemistry of surfaces, 4th edn., Wiley - Interscience, Newyork, 1982.

REFERENCE BOOKS

1. P.W. Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford, 1983
2. M.W.Hanna, Quantum Mechanics in Chemistry, W.A.Benjamin Inc. London 1965
3. S. Glasstone, Thermodynamics for Chemists, Affiliated East West Press, New Delhi 1960.
4. K.J.Laidler, Chemical Kinetics, Harper and Row, New York,1987.
5. R.G. Frost and Pearson, Kinetics and Mechanism, Wiley New York, 1961
6. R.K.Prasad, Quantum Chemistry, Wiley Eastern, New Delhi,1992.
7. A.W.Anderson, Physical Chemistry of Surfaces, Wiley - Interscience, Newyork, 1990.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER II
CORE PRACTICAL I - ORGANIC CHEMISTRY PRACTICAL I

I. Identification of components in a two component mixture and preparation of their derivatives. Determination of boiling point/melting point for components and melting point for their derivatives.

II. Preparation.

1. Beta naphthyl methyl ether from beta naphthol
2. s-Benzyl isothiuronium chloride from benzylchloride
3. Beta glucose penta acetate from glucose
4. ortho-Benzoyl benzoic acid from phthalic anhydride
5. Resacetophenone from resorcinol
6. para-Nitrobenzoic acid from para nitrotoluene
7. meta-Nitroaniline from meta dinitrobenzene
8. Methyl orange from sulphanilic acid
9. Anthraquinone from anthracene
10. Benzhydrol from benzophenone

REFERENCE BOOKS:

1. B.S.Furniss, A.J.Hannaford, P.W.G.Smith and A.R.Tatchell, Vogel's Practical Organic Chemistry.5th Edn., ELBS, 1989.
2. Raj K.Bansal, Laboratory manual of Organic Chemistry, III Edn., New Age International (P) Ltd.1996.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER II
CORE PRACTICAL II
INORGANIC CHEMISTRY PRACTICAL I

Part I

Semimicro qualitative analysis of mixtures containing two common and two rare cations. The following are the cations to be included: W, Tl, Mo, Te, Se, Ce, Th, Be, Zr, V, U and Li..

Part II

a) Colorimetric analysis : Visual and Photometric; determination of iron, nickel, manganese and copper.

b) Preparation of the following:

a) Potassium trioxalatoaluminate (III) trihydrate

b) Tristhioureacopper(I) chloride

c) Potassium trioxalatochromate (III) trihydrate

d) Sodium bis (thiosulphato) cuprate (I)

e) Tetramminecopper (II) sulphate

f) Potassium Tetrachlorocuprate (II)

REFERENCES BOOKS:

1. G.Svehla, Vogel's qualitative Inorganic analysis, VI Edition, Orient Longman, 1987.
2. V.V.Ramanujam, Inorganic Semimicro Qualitative analysis, National Publishing Co., 1971.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER I
CORE PRACTICAL III
PHYSICAL CHEMISTRY PRACTICAL I

LIST OF EXPERIMENTS

1. Study the kinetics of acid hydrolysis of an ester, determination of the temperature coefficient of the reaction and determination of the activation energy of the hydrolysis of ethylacetate.
2. Study the kinetics of the reaction between acetone and iodine in acidic medium by half life method and determine the order with respect to iodine and acetone.
3. Construction of phase diagram for a simple binary system (naphthalene – phenanthrene and benzophenone – diphenylamine).
4. Determination of the rate constant and order of reaction between potassium persulphate and potassium iodide and determine the temperature coefficient and energy of activation of the reaction.
5. Determination of equivalent conductance of a weak acid at different concentrations and verify Ostwald's dilution law and calculation of the dissociation constant of the acid.
6. Determination of equivalent conductivity of a strong electrolyte at different concentrations and examine the validity of the Onsager's theory as limiting law at high dilutions.
7. Conductometric titrations of a mixture of HCl and CH3COOH against Sodium hydroxide
8. Determination of the activity coefficient of an electrolyte at different molalities by emf measurements.
9. Determination of the dissociation constant of acetic acid by titrating it with sodium hydroxide using quinhydrone as an indicator electrode and calomel as a reference electrode.
10. Determination of the PH of a given solution by emf method using hydrogen electrode and quinhydrone electrode.
11. Determination of the partial molar volume of glycine/methanol/formic acid/ sulphuric acid by graphical method and by determining the densities of the solutions of different compositions.
12. Study the surface tension – concentration relationship of solution (Gibb's equation)
13. Determination of the viscosities of mixtures of different composition of liquids and find the composition of a given mixture.

REFERENCE BOOKS:

1. B.P.Levitt (Ed.). Findlay's Practical Physical Chemistry, 9th Edn., Longman, London, 1985.
2. J.N.Gurtu and R.Kapoor, Advanced Experimental Chemistry, Vol I.S.Chand & Co. Ltd., New Delhi, 1980.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSES

LIST OF EXTRA DISCIPLINARY COURSE PAPERS

I. Industrial Chemistry

II. Agricultural Chemistry

III. Food and Medicinal Chemistry

IV. Pharmaceutical Chemistry

V. Dye Chemistry

VI. Water Chemistry

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER-I- INDUSTRIAL CHEMISTRY

(60 Hours)

UNIT-I Glass and Ceramics (12 Hours)

1.1 Glass: Introduction. Raw materials, manufacture and applications. Some special glasses-fused si l i ca glass, optical glass, glass wool, photosensitive glass-composition and uses.

1.2 Ceramics: Definition. Manufacture and applications.

UNIT-II Cement (12 Hours)

Cement: Introduction, Types of cement- High alumina cement, Slag cement, Acid resisting cement, White cement, Types of Portland cement, Raw materials, Manufacture of cement, Setting of cement, factors affecting quality of cement, Cement industries in Tamilnadu.

UNIT-III Dyes and Paints (12 Hours)

3.1 Dyes: Classifications of dyes, application of dyes in other areas-medicine, chemical analysis, cosmetics, colouring agents, Food and beverages.

3.2 Paints: Constituents of paints, Manufacture of paints, Setting of paints, requirement of a good paint, paint failure.

UNIT-IV Synthetic fibres and Plastics (12 Hours)

4 .1 Synthetic fibres: Difference between natural and synthetic fibres, Applications of synthetic fibres-Rayon, Terylone, Nylon. Taflon.

4 .2 Plastics: Domestic and industrial applications of all types of plastics.

UNTI-V Oils, Fats and Waxes (12 Hours)

Classification of oils, fats and waxes, distinction between oils, fats and waxes, Uses of essential oils and fats. Soap and its manufacture toilet and transparent soaps cleansing action of so ap Detergent – classification and uses.

TEXT BOOKS

1. B.K. Shanna, Industrial Chemistry, Goel Publishing House Pvt Ltd. 1999.
2. M.G. Arora and M. Sin«h, Industrial Chemistry. Anmol Publications, 1st edition, 1994.
3. G.N.Pandey, A Textbook of Chemical Technology. Vol. I and I I, Vikas Publishing House Pvt Ltd. 1997.

REFERENCE BOOKS

1. B.K. Chakrabarty, Industrial Chemistry, Oxford &IBM Publishing CO. Pvt Ltd. 1991.
2. V. Subrahmaniyan, S. Renganathan. K.Ganesan, S.Ganesh. Applied Chemistry. Scitcch Publications, 1998.
3. J.E.Kuria Cose and J.Rajaram,Chemistry in Engineering & Technology. Vol.1 & I I , T a t a Mc Craw Hill. 1984.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER- II- AGRICULTURAL CHEMISTRY

(60 Hours)

UNIT-I Water source for Agriculture (12 hours)

Water treatment and water analysis-acidity, alkalinity, pH, Biological oxygen demand (BOD). Chemical oxygen demand (COD) and their determinations, Recycling of water, water management.

UNIT - II Chemistry of soil, soil classification and soil analysis (12 Hours)

Definition, classification and properties of soil, Soil erosion, Soil fertility, Soil organic matter and their influence on soil properties, Soil reactions- soil pH, acidity, alkalinity, buffering of soils and its effect on the availability of N, P, R. Ca and Mg.

UNIT-III Irrigation (12 Hours)

Crop Seasons-seed, seed development organization, natural seeds projects phase-III, new policy on seed development; Soil- soil reclamation, alkali soil, saline soils, methods for soil reclamation; Irrigation Environmental degradation and Irrigation projects.

UN1T-IV Fertilizers (12 Hours)

4.1 Fertilizers: Effect of Nitrogen, potassium and phosphorous on plant growth. Secondary nutrients – micronutrients- their functions in plants classification of fertilizers, natural fertilizers, artificial fertilizers, phosphate fertilizers; Manufacture of urea and triple super phosphate

4.2 Manures: Bulky organic manures- Farm yard manure- handling and storage, oil cakes. Blood meal, fish manures.

UNIT-V Pesticides and Insecticides (12 Hours)

5.1 Pesticides; Classification of Insecticides, fungicides herbicides as organic and inorganic, general methods of application and toxicity, safety measures when using pesticides.

Insecticides: Plant products-Nicotine, pyrethrin, Inorganic pesticides-borates organic pesticides - D.D.T and BMC.

5.2 Fungicide and Herbicides:

Fungicide: Sulphur compounds, copper coumpounds, Bordeaux mixture,

Herbicides: Acaricides- Rodenticides, Attractants- Repellants, Preservation of seeds.

TEXT BOOKS

1. N.C. Brady, The nature and properties of soils, Eurasia publishing House, New Delhi. 1977.
2. V.S, Jones. Fertilizers and soil fertility, Prentice Hall of India, New Delhi, 1993.
3. D.E.H. Freer, Chemistry of pesticides, D. Van Nostrand Co, Reinhold, 1969.
4. A.K. De. Environmental Chemistry, Wiley Eastern. 1989.

REFERENCE BOOKS

1. A. Sankara. Soils Science.
2. R.C. Palful. K. Goel. R.K. Gupta, Insecticides, Pesticides and Agro based Industries.
3. B.K. Sharma, Industrial Chemistry.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER- III- FOOD AND MEDICINAL CHEMISTRY

(60 Hours)

UNI I -I Food (12 Hours)

1.1 Food Adulteration

Sources of food, types, advantages and disadvantages, constituents of foods, carbohydrates, proteins, fats and oils, colours, flavours, natural toxicants.

1.2 Food poisoning

Sources, causes and remedy- Causes and remedies for acidity, gastritis, indigestion and constipation.

1.3 Food preservation

Food spoilage, causes of food spoilage, types o flood spoilage, food preservation.

UNIT-II Vitamins and minerals (12 Hours)

2.1 Vitamins: Sources, requirement, deficiency diseases of A. B. C. H and K.

2.2 Minerals: Mineral elements in food-principal mineral elements - Source-Function - Deficiency and daily requirements- Na, K. Mg. Fe, S. P and I.

UNIT-III (12 Hours)

3.1 Antibiotics: Definition, Classification as broad and narrow spectrum, mode of action and uses of penicillin, Chloramphenicol, tetracyclines, ciphalosporin, ampicillin and erythromycin.

3.2 Sulphonamides: Mechanism and action of sulpha drugs, preparation and uses of sulphadiazine, sulphathiazole, sulphapyridine and sulphafurazole.

3.3 Analgesics- definition- narcotic and non-narcotic- morphine and its derivatives- pethidine and methodone - pharmacological action- uses and abuses. Heroin and codinine. Antipyretic analgesics- Preparation and uses of aspirin and paraacetamol.

UNIT-IV (12 Hours)

4.1 Antiseptics and disinfectants- definition and distinction- phenol coefficient, phenol as disinfectant, chlorhexidinc, formaldehyde and nitrofurazone-uses.

4.2 Anaesthetics- definition- classification- local and general- volatile, nitrous oxide, ether, chloroform, cyclopropane- uses and disadvantages- nonvolatile- intravenous- thiopental sodium, methohexitone, propanidide, local anaesthetics- cocaine and benzocaine- uses and disadvantages.

UNIT-V (12 Hours)

5.1 Drugs affecting CNS- Definition and one example for tranquilisers, sedatives, hypnotics, psychedelic drugs- chlorpromazine and barbitone- uses

5.2 Hypoglycemic agents- Diabetes- types- causes- symptoms- Insulin- uses. Oral hypoglycemic agents- sulphonyl ureas- action and uses.

5.3 Antineoplastic drugs- Causes for cancer, Antineoplastic agents, cytotoxic. anti-metabolites, plant products, harmones- one example and uses

5.4 AIDS-causes, prevention and control.

5.5 Indian medicinal plants and uses- tulasi, kilanelli, mango, semparuthi, adadodai and thoothuvalai.

TEXT HOOKS

1. Seema Yadav. Food Chemistry. Anmol publishing (P) Ltd, New Delhi.
2. T.C. Daniels and E.C. Jorgensen. Text book of organic medicinal and pharmaceutical chemistry, J.B. Lippincott, Philadelphia. 1997.
3. Ashutosh Kar, Medicinal Chemistry, New Age International, 1996.
4. Bentley & Drivers. Text Book of Pharmaceutical Chemistry.

REFERENCE BOOKS

1. S. Lakshmi. **Pharmaceutical Chemistry,** Sultan Chand & Sons, New Delhi.
2. Car H. Synder, **The Extraordinary Chemistry for ordinary things.** John Wiley & Sons inc.,, New York, 1992.
3. A. Singh and V.K. Kapoor, **Organic Pharmaceutical Chemistry.**
4. I.L. Firnar, **Organic Chemistry,**VoI-II.
5. SJ. Bown and C.W.J. Scaife, **Chemistry & Life Science Approach.**
6. Albert Lehninger. **Bio Chemistry.**
7. G.R. Chatwal, **Pharmaceutical Chemistry Organic.** Vol-II,
8. G.R. Chatwal, **Pharmaceutical Chemistry Inorganic,** Vol-I.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER-IV-PHARMACEUTICAL CHEMISTRY

(60 Hours)

UNIT -I (l2Hours)

Inroduction: Importance ofChemistry in pharmacy. Important terminologies used, their meaning- molecular pharmacology, pharmacodynamics, phamacophore, metabolites, antimetabolites, bacteria, virus, fungi, actinomycetes.

Names of drugs: Code no. Chemical, proprietary, trivial, trade, non-proprietary names- meaning only. Assay- biological, chemical, immunorological - statement only. Mechanism, metabolism of drugs and their effect on pharmacological activity. Absorption of drugs.

Drug delivery systems, sustained release of drugs. Physiological effects of different functional groups in drugs.

UNIT-II (12 Hours)

2.1 Indian Medicinal plants and trees- adathoda, tulsi, thoothuvalai, shoeflower, neem. mango, kizhanelli. Ocimum, grass and greens.

2.2 Antibiotics: Definition. Structure- uses of chlorarnphenicol- ampicillin. streptomycin, tetracyeline- ritaniycin, Macrolidcs- Erythromycin- properties and uses.

Structural features- SAR- functional group responsible for drug action. Structural modification that changes the potency of the above drugs. Conditions for their use as therapeutic agents. Fields of application.

2.3 Sulphonamides: Substituents in the amide group. General properties and drug action. Preparation and uses of sulphadiazine, sulphapyridine, sulphathiazole, sulphafurazole and prontosil.

UNIT-III (12 Hours)

3.1 Antineoplastic drugs: Causes for cancer, Antineoplastic agents, cytotoxic. antimetabolites, plant products, harmones.

3.2 Antipyretic, analgesics, anti-inflammatory agents: Classification. Action of analgesics. Narcotic analgesics- Morphine and its derivatives. SAR.

Synthetic analgesics- pethidine and methadones.

Salicylic acid and its derivaties, indolyl derivatives, aryl-acetic acid derivatives, pyrazole. p-aminophenol derivatives- mechanism of action.

3.3 Antiseptics and disinfectants: Definition. Standardizalion of disinfectants, Use of phenols, dyes, chloramines, chlorohexadiene, Organomercurials, Dequalinium chloride, formaldehyde. Cationic surface active reagents, chloraminet-nitrofurazone.

Distinction between antiseptics and disinfectants.

UNIT – IV (12 Hours)

4.1 Hypoglycemic drugs: Diabetes-types-causes. Contol symptoms. Control, Insulin-preparation, uses. Oral Hypoglycemic agents, Sulphonylureas.

4.2 Anaesthetics: Definition, Classification. Uses of volatile anaesthetics - nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloroethylene, ethyl chloride - storage, advantages and disadvantages, intravenous anaesthetics-thiopenta! sodium, methohexitone, propanidide.

Local anaesthetics: requisites. Uses of esters - cocaine, benzocaine, procaine, amethocaine. Proxymelacaine, Amides- Lignocnine, cinchocaine hydrochloride.

UNIT-V (12 Hours)

5.1 Haematological agents: Coagulants and anticoagulants; Coagulants: vitamin K, Protamine sulphate, dried thrombin, Proteins, amino acids, Anticoagulants - Coumarins, indanediols. citric acid, 2-sulphonyl acids, quinoxaline, throm lodyn, Haemostatics - amino caproic acid, transexamic acid, Anaemia: Causes, detection, antianaemic drugs.

5.2 Cardio Vascular drugs: Cardiac glycosides, antiarrhythmic drugs, antihypertension drugs, antianginal agents, vasodilators, lipid lowering agents. One example for each.

TEXT BOOKS

1. T.C. Daniels and E.C. Jorgensen. Text book of organic medicinal and pharmaceutical chemistry, J.B. Lippincott, Philadelphia, 1997.
2. Ashutosh Kar, Medicinal Chemistry, Ne\v Age International. 1996.
3. Bentley & Drivers, Text Book of Pharmaceutical Chemistry.

REFERENCE BOOKS

1. S.Lakshmi, Pharmaceutical Chemistry. Sultan Chand & Sons, New Delhi.
2. A. Singh and V.K. Kapoor, Organic Pharmaceutical Chemistry.
3. l . L.Finar, Organic Chemistry. Vol-Il.
4. S.J. Bown and C.W.J. Scaife, Chemistry & Life Science Approach.
5. Albert Lehninger. Bio Chemistry.
6. G.R. Chatwal, Pharniaeentical Chemistry Organic. Vol-II.
7. G.R. Chatual, Pharmaceutical Chemistry Inorganic, Vol-I.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER-V- DYE CHEMISTRY

(60 Hours)

Unit I Introduction (12 Hours)

Colour and chemical constitution - chromophore, auxochrome and resonance, various theories; History of natural and synthetic dyes; Names of commercial dyes; Study of raw materials and dyestuff intermediates; Unit operations - nitration, sulphonation, halogenation, amination, diazotisation and alkali fusion; Colour index and its significance; Classification of dyes based on chemical constitution and method of applications; General properties - linearity, coplanarity and fastness.

Unit II Direct, Acid and Basic Dyes (12 Hours)

Direct cotton dyes (substantive dyes) – Classification, properties, structure and mechanism of dyeing, post treatment of dyeing; Acid dyes and Basic dyes – Classification, Characteristics, trade names, Mechanism of dyeing, Nature of affinity on cellulose and protein fibres.

Unit III Mordant, Azo and Vat Dyes (12 Hours)

Mordant dyes – classification, methods of application; Metal complex dyes – types of bond formation between dye and various fibres; Azo dyes – Azoic coupling components, protective colloids, electrolytes, stabilisation of diazonium salts, principles and application; Vat dyes and solubilised vat dyes – classification, methods of application, trade names, principles and application, Stripping agents and correction of faulty dyeing.

Unit IV Other Dyes (12 Hours)

Chemistry involved in the production of Aniline black; Prussian black; Sulphur colours; phthalocyanines; Disperse dyes - classification based on chemical structure, properties and principles of application; Solvent soluble dyes - Nigrosines and Indulines; Cyanine dyes.

Unit V Colour and Brightening (12 Hours)

Fluorescent brightening agents (FBA) - Theory and applications; Identification and estimation of dyes on fibres; The action of light on dyes and dyed fibres; Mechanism of fading.

TEXT BOOKS:

1. K. Venkataraman, The chemistry of synthetic dyes Part I & II, Academic Press, New York, 1952.
2. V. A. Shenai, Introduction to Chemistry of Dyesuffs, Sevak Prakashan Pub., Mumbai, 1991.

REFERENCE BOOKS:

1. V. A. Shenai, Chemistry of Dyes and Principles of Dyeing Vol.-II, Sevak Prakashan, Mumbai, 1987.
2. V. A. Shenai, Ecology and Textiles, Sevak Publications, Mumbai, 1997.
3. D. M. Nunn, The Dyeing of Synthetic Polymer and Acetate Fibres, Dyers Company, Publication Trust, 1979.
4. V. A. Shenai, Toxicity of Dyes and Intermediates, Sevak Publications, Mumbai, 1998.
5. Directory of safe dyes conforming to German Consumer Goods Ordinances, The Dyestuff Manufacturers Association of India, 1996.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER II

EXTRA DISCIPLINARY COURSE

PAPER-VI- WATER CHEMISTRY

(60 Hours)

Unit I Introduction (12 Hours)

Sources of Water; Physical and chemical characteristics of water; Water analysis; Potable water – WTO standard: uses of water

Unit II Water Pollution (12 Hours)

Water pollution – wastewater generation - classification of water pollutants; constituents and characteristics of wastewater; measurement techniques – sampling, colour & odour, dissolved oxygen, BOD, COD, TOC, N & P, suspended solids and bacteriological measurements.

Unit III Wastewater Treatment (12 Hours)

Wastewater treatment: Pretreatment – screening, grit removal and pre-chlorination; Primary treatment – settling and sedimentation; Secondary treatment – trickling filter process, activated sludge process; Aeration.

Unit IV Industrial Wastewater Treatment (12 Hours)

Industrial wastewater treatment: Activated sludge treatment plants – mass balances, with and without recycle plants; Types of plants – single tank, contact stabilization, biosorption plants.

Biofilters: Hydraulic film diffusion, two component diffusion; Types of plants – trickling filters, submerged filters and rotating disc; removal of particulate organic matter.

Unit V Treatment Plants (12 Hours)

Treatment plants for nitrification – mass balances, nitrifying plants and types of plants.

Treatment plant for denitrification - mass balances, denitrifying plants and types of plants; redox zones in the biomass.

TEXT BOOKS

1. A.K.De, Environmental Chemistry, Wiley Eastern, 1989.
2. S.K.Banerji, Environmental Chemisty, Prentice Hall of India, New Delhi, 2003.

REFERENCE BOOKS

1. L.Winther, Wastewater Engineering, Polyteknisk Forlag, Lyngby, 1978.
2. M.Henze, P.Harremoes, J.C.Jansen and E.Arvin, (Ed.), Wastewater treatment, Springer Verlag, New York, 1995.
3. P.Harremoes, Water Chemistry, Polyteknisk Forlag, Lyngby, 1989.

Model question paper

(For the candidates admitted from 2012-2013 onwards) M.Sc/ M.A/ M.Com/ M.C.A Degree Examinations Second Semester

EDC - PAPER-I - INDUSTRIAL CHEMISTRY

Time: 3hrs Maximum: 75 marks

PART-A

Answer all questions, either (a) or (b)

1. a) Write an account of optical glass and photosensitive glass (Or)
   b) Explain the raw materials used in the manufacture of glass
2. a) Explain the theory of setting of cement (Or)
   b) What is Portland cement? Give its rough composition
3. a) Mow are dyes classified? (Or)
   b) What are paints? Discuss the essential components of a good paint.
4. a) Distinguish between natural fibres and synthetic fibres? (Or)
   b) Write notes on Rayon and Nylon.
5. a) i) What are essential oils? Give an example.
   ii) Give two examples for waxes. (Or)
   b) Explain the cleansing action of soaps.

PART-B (10x5-50 Marks)

Answer alt questions, either (a) or (b)

6. a) How is glass manufactured? (Or)
   b) Discuss the manufacture and uses of ceramics.
7. a) How is cement manufactured? (Or)
   b) i) What are the types of cement ((4)
   i i) Write an account of the factors affecting the quality of cement(6)
8. a) Give an account of the application of dyes (Or)
   b) i) How is paint manufactured? (6)
   ii) What arc the qualities of good paint?-(4)
9. a) Write notes on synthetic fibres (Or)
   b) Describe in detail the applications of plastics.
10. a) i) How are waxes classified?(3)
   ii) Discuss the steps involved in the process of soap making(7) (Or)
   b) i) Distinguish between soups and detergents(6)
   i i) Write briefly about the various types of soaps.*(4)*

Model Question Paper

(For the candidate admitted from 2017-2018 onwards)

M.Sc. DEGREE Branch - IV (C) - Analytical Chemistry

First Semester- Core Paper - II

Inorganic Chemistry- I

Time : 3 hours Maximum : 75 marks

PART - A (5X5=25 Marks)

Answer all the questions

1) a) Briefly explain any one theory of Hardness - Softness of acid bases. (or)
   b) What are Phosphazenes? Give their formulae and shape.
2) a) Give preparation and structure of carboranes. (or)
   b) Explain the structure and preparation of hydroborate ion.
3) a) Explain mode of decay of radioactive substance. (or)
   b) Write a note on nuclear isomerism and nuclear cross section.
4) a) Discuss a nuclear transmutation and fission. (or)
   b) Write a note on stellar energy.
5) a) Write a note on cloud chamber method. (or)
   b) Explain G.m. counter.

PART - B (5X10=50 Marks)

Answer all the questions

6) a) Draw and explain the various silicate structure in detail. (or)
   b) Write briefly about the heteropoly acids of molybdenum and tungsten.
7) a) Write a note on metallocarboranes and metal clusters. (or)
   b) Give a short account of metal clusters.
8) a) Write a note on factors affecting stability of nuclei (or)
   b) Write a note on threshold energy and excitation functions
9) a) Explain application of radioactive isotopes in agriculture and medicine (or)
   b) Explain i) isotopic dilution analysis
      ii) Neutron activation analysis
10) a) Discuss particle accelerators
      i) linear accelerator ii) Cyclotron (or)
    b) Explain synchrotron and Bevatron

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER III
CORE VII - ANALYTICAL CHEMISTRY – I
[75 Hours]

UNIT I Conductometric Titrations (15 Hours)

Conductometric titrations – General concept and basis of conductometric titrations, apparatus and measurement of conductivity, Applications of direct conductometric measurements.

High frequency methods – Theory, apparatus, merits of low and high frequency analysis (oscillometry), determination of non-ionic species in process control and zone detector.

Dielectrometry – Theory, methods, equipment and applications.

UNIT II Potentiometric Titrations (15 Hours)

Standard and formal potentials, types of electrodes. Glass membrane, precipitate and solid state electrodes, liquid membrane electrodes, mechanism of electrode, response and evaluation of selectivity coefficient, application of ion-selective electrodes. Methods – manual titrimeters and automated titrators, Direct potentiometry and potentiometric titrations including differential methods, acid – base titrations in non-aqueous systems.

Bipotentiometry – Principle, instrumentation and applications.

UNIT III D.C. Polarography & Voltammetry (15 Hours)

Polarography – Theory, apparatus, DME, diffusion and kinetic and catalytic currents, current – voltage curves for reversible and irrerversible systems, qualitative and quantitative applications of polarography to organic and inorganic systems. Derivative polarography, Test polarography, Pulse polarography – Normal and derivative, square wave polarography and AC polarography.

Linear sweep and cyclic voltammetry, anodic and cathodic stripping voltammetry.

UNIT IV Amperometry (15 Hours)

Amperometric titrations – Theory, apparatus, types of titration curves, successive titrations and two indicator electrodes – applications. Technique of amperometric titrations with the dropping mercury electrode – Titration with the rotating platinum microelectrode. Examples of amperometric titrations using a single polarized electrode, biamperometry – Theory and applications.

UNIT V Coulometric and Electrogravimetric Analysis (15 Hours)

Theory. Faraday's laws, coulometers – types of macro and micro techniques, coulometric titrations, external and insitu generation, coulogravimetry and applications, Elementary aspects of chronocoulometry.

Electrogravimetry – Theory of electrogravimetry , order of deposition, over potential, polarization curves, constant potential and consecutive deposition, selective deposition, constant current deposition, assembly of electrode and deposition of complex ions.

Microelectrode deposition including radioactive metal ions. Autoelectrogravimetry, Principle and instrumentations, electrography and its applications.

TEXT BOOKS

1. Willard, Merit Dean and Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, IV Edn. 1986.
2. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub. Co, III Edn., 1985.
3. A.I. Vogel, Text Book of Quantitative Inorganic Analysis, ELBS III and IV Edn.
4. J.O.M. Bockris and AKN Reddy, Modern Electrochemistry, Plenum, 1970.
5. D.A. Skoog and D.M. West, Fundamentals of Analytical Chemistry, Holt Rinehart and Winston Publications, IV Edn, 1982.
6. H. Kaur, Instrumental Methods of Chemical analysis, Pragati Publishers, 2006.

REFERENCE BOOKS

1. Albert Paul Malvino, Electronic Principles, PMH Publishers, III Edn, 1984.
2. J.G. Dick, Analytical Chemistry, McGraw Hill Publishers, 1974.
3. G.W. Ewing, Instrumental Methods of Chemical Analysis, McGraw Hill Pub, 1975.
4. B.H. Vassos and G.W. Ewing, Electroanalytical Chemistry, John Wiley and Sons, NY, 1983.
5. R. Greef, R. Peat, L.M. Peter, D. Pletcher and J. Robinson, Instrumental methods in Electrochemistry, Ellis Horwood, Chichester, 1985.
6. A.J. Bard and L.R. Faulkner Electrochemical methods, Fundamentals and Applications, J. Wiley and Sons, NY, 1980.
7. I.M. Kolthoff and P.J. Elving, Treatise on Analytical Chemistry, Part I, Vol 4, Wiley, NY, 1959.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER III

CORE VIII - ANALYTICAL CHEMISTRY – II

[75 Hours]

UNIT I Basic Separation Technique – I (15 Hours)

General aspects of separation techniques – Role of separation technique in analysis, Classification choice of separation method distribution processes, discrete and continuous equilibria, distribution behaviour and chemical structure, errors resulting from separation process.

Extraction – Distribution law and derivation, solvents and their choice, tenchniques – batch and continuous, multiple extraction, column and their choice, extraction of solids and their applications.

Precipitation and crystallization – Theory and mechanism of fractional precipitation and crystallization, Variables and control of variables, type of precipitation, organic precipitation and their application.

UNIT II Chromatographic Techniques -I (15 Hours)

Thin Layer chromatography – Techniques and applications, Modified stationary phases. Ion – exchange chromatography – Techniques and applications Gas chromatography – Types and nature of stationary and mobile phase, solid supports and their choice, columns – packed, open and capillary, sampling methods instrumentation, detectors – types sensitivity, limits of detection operative principles of TCD, FID and ECD, Comparison of detectors temperature programming, derivative chromatography, hyphenated techniques with GSGC qualitative and quantitative applications.

UNIT III Chromatographic Techniques -II (15 Hours)

Gel permeation chromatography – Instrumentation, heterogeneity factor, determination of molecular weights - weight average and number average, analytical and industrial applications.

Liquid chromatography – High pressure liquid chromatography. Theory and equipment, type of pumps and their choice, types of columns, large scale separation, application in analytical chemistry and in industry.

New development in chromatography – Plasma chromatography, super critical fluid chromatography.

UNIT IV UV-Visible and Microwave Spectroscopy (15 Hours)

Absorption spectrometry – Beer Lambert's law, filter photometry, spectrophotometry – UV visible, photometric titrations, reaction rates, complex studies, Fluorometry, turbidimetry and nephelometry.

Microwave spectroscopy – Theory, instrumentation – source, monochromators, detectors, sample handling, qualitative analysis and quantitative applications

c) Green solvents: water, ionic liquids, supercritical carbon dioxide.

d) Solid state reactions: solid phase synthesis, solid supported synthesis

UNIT – V Infra Red and Raman Spectroscopy (15 Hours)

Infra – red spectroscopy – Theory, instrumentation – source of monochromators, detectors, dispersive and non dispersive instruments, sample handling techniques, internal reflection spectroscopy, qualitative analysis and quantitative applications.

Raman spectroscopy – Theory, Instrumentation – source of radical detectors, application of Raman spectra to inorganic, organic and biological species, quantitative applications, Resonance Raman spectroscopy.

TEXT BOOKS

1. Willard, Merit Dean and Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, IV Edn, 1986.
2. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub. Co, III Edn., 1985.
3. A.I. Vogel, Text Book of Quantitative Inorganic Analysis, ELBS III and IV Edn.
4. D.A. Skoog and D.M. West, Fundamentals of Analytical Chemistry, Holt Rinehart and Winston Publications, IV Edn, 1982.
5. H. Kaur, An Introduction to Chromatography, Pragati Publishers, 2006.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER III

ELECTIVE PAPER - II

DATA TREATMENT & TITRIMETRIC ANALYSIS

(75 Hours)

UNIT I Treatment of Analytical Data (15 Hours)

Nature of quantitative measurements and treatment of data. Basic statistical concept-Frequency distribution, Average and measure of dispersion, Significance of Gaussian distribution curves, Null hypothesis, confidential interval of mean, Rejection data, student's t, Q and F tests, Regression and correlation, quality control and control chart.

Objectives, sampling-size of sample handling, transfer and storage samples.

UNIT II Small Scale Manipulation and Chemical Equilibria (15 Hours)

Microchemical laboratory-Design, safety screen, fume chamber, heating, water supply, dry box/glove box, microbalance, quartz balance, fiber microgram balance.

Trace analysis in solution, Nature of trace analysis, scale of working sensitivity, sources of errors, Contamination control in trace analysis.

Activity concept, equilibrium constant and applications. Ionization constants of acids and bases.

Concept of pH, hydrolysis of salts, hydrolysis constant and degree of hydrolysis. Buffers-types, range and capacity. Dissociation of polyprotic acids, commonion effects, salt effect.

UNIT III Titrimetric Analysis I (15 Hours)

Neutralization reactions – theory of acid-base titrations, mono and polyprotic systems, Titration curves and feasibility of reactions, Indicators-theory and choice, calculation of pH during titrations.

Homogeneous precipitation – Theory and applications of a few common gravimetric determinations (sulphate, chromate, oxalate and phosphate).

UNIT IV Titrimetric Analysis II (15 Hours)

Redox titrations – Redox potentials, theory and feasibility of redox titrations, calculation of potentials at different stages of titrations, redox indicators, their choice and application.

Precipitation titrations – Theory and types, volhard, Mohr and Fejan's methods. Adsorption indicators – theory, choice and applications.

Complexometric titrations – Theory, stepwise and overall formation constants, titrations involving monodendate (Cl-, CN-) and multidendate ligands (EDTA). Metallochromic indicators – theory and choice. Masking and demasking and extractive methods. Direct, indirect (including substitution) titrations and applications.

UNIT V Computer Applications in Chemistry (15 Hours)

Input and Output statements, Transfer and control statements, programming in BASIC only for calculation of equilibrium constants, pH of a buffer, potentiometric titrations and standard deviation.

MS-Word, MS-Excel, MS-Power Point and Internet usage.

TEXT BOOKS

1. D.A. Skoog and D.M. West, Fundamentals of Analytical Chemistry, Holt Rinehart and Winston Publications, IV Edition, 1982.
2. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub. Co, III Edition, 1985.
3. A.I. Vogel, Text Book of Quantitative Inorganic Analysis, ELBS III and IV Edition.
4. J.G. Dick, Analytical Chemistry, McGraw Hill Publishers, 1974.
5. T.S.Ma and V. Horak, Microscale-Manipulations, John, Wiley and Sons, 1976.
6. P.C. Jurns, T.L. Isenhour and C.C. Wilkins, Basic Programming for Chemists, JW & Sons, 1987.

REFERENCE BOOKS:

1. K.V. Raman, Computers in Chemistry, Tata McGraw Hill, New Delhi, 1993.
2. Albert Paul Malvino, BASIC Programming, PMH Publishers, III Edition, 1984.
3. N. Subramanian, Programming for BASIC, A.H. Wheeler and Co. Pvt. Ltd III Edition, 1987.
4. Peter C. Jurs, T.L. Isenhour and C.L. Wilkins, BASIC Programming for Chemist, John Wiley and Sons, 1987.
5. Willard, Merit Dean and Settle, Instrumental Method of Analysis, CBS Publishers and Distributors, IV Edition, 1989.
6. G.D. Christian and J.E.O Reilly, Instrumental Analysis, Allyn and Bacon Inc, II Edition, 1986.
7. G.W. Ewing, Instrumental Methods of Chemical Analysis, McGraw Hill Pub., 1975.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER III

ELECTIVE PAPER - III

OPTICAL METHODS AND THERMAL ANALYSIS

[75 Hours]

UNIT I Thermal and Magnetic Methods of Analysis (15 Hours)

DTA / DSC – Principle and instrumentation, Different techniques. Application to organic and inorganic compounds.

TGA – Principle, instrumentation of TGA curves, Application to organic and inorganic compounds.

Magneto chemical Analysis – Magnetic susceptibility and its measurements, Guoy's, Quink's, Curie's and Ranking's balances. Application to simple compounds, ranking's transition metal complexes, Lanthanides and Actinides.

UNIT II Electron Spectroscopy (15 Hours)

Introduction, ESCA, X- ray photoelectron and electron impact spectroscopy – instrumentation, sample preparation and application.

X – ray Theory of generation, secondary fluorescence and X- ray spectroscopy, instrumentation and application to analysis of alloys, minerals and antiques.

Comparison with optical spectroscopy, X- ray absorption – theory and measurements, microradiology and its application to the analysis of alloys.

Auger electron spectroscopy – Theory, instrumentation and general applications.

UNIT III Optical and Reasonance Techniques (15 Hours)

Emission Techniques – Theory, techniques of excitation, electrodes and their shapes, flame emission and plasma emission spectrometry – instrumentation and applications.

Ion cyclotron resonance – Introduction, theory and techniques – analytical applications – analysis of gases and neutral compounds.

ORD and CD – Cotton effect – axial haloketone rule and Octant rule – conformation and configuration determination.

UNIT IV Microscopy (15 Hours)

Chemical microscopy – Microscope – Parts and optical path: Numerical aperture and significance. Techniques – Kofler's hot stage microscope, fluorescence, polarizing, interference and phase microscopy, application and qualitative and quantitative study.

Electron microscopy – Principle, Microscope and its operation, sample preparation, replicas, shadowing, application to analysis, electron probe analyzer, ion microscope metallography – metallurgy, microscopic examination, specimen preparation and examination, interpretation of micrographs.

UNIT V Polarimetry & Refractometry (15 Hours)

Polarimetry – Theory and instrumentation, specific and molecular rotations, applications, spectropolarimetry.

Refractometry – Theory, instrumentation, specific and molecular refraction, Abbe, Pulfrich and immersiton types, applications.

Light scattering – Theory of inter and intraparticular interferences, description of a simple scatterometer, determination of molecular weights.

TEXT BOOKS

1. H.A. Stobel Addison, Chemical Instrumentation, Wesley Pub. Co. 1976. Chapman & Hall, 1986.
2. D. Kealey, Blackie, Experiments in Modern Analytical Chemistry, Chapman & Hall, 1986.
3. Willard, Merit Dean and Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, IV Edn. 1986.
4. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub. Co, III Edn, 1985.

REFERENCE BOOKS:

1. J.G. Dick, Analytical Chemistry, McGraw Hill Publishers, 1974.
2. G.W. Ewing, Instrumental Methods of Chemical Analysis, McGraw Hill Pub, 1975.
3. R.C. Mackeniz, Differential Thermal Analysis, Acad Press, 1970.
4. E.M. Chamot & C.W. Mason, Hand Book of Chemical Microscopy, John Wiley Vol I and II, 1944.
5. R. Drago, Physical methods in Inorganic chemistry, Reinhold, NY, 1968.
6. G.W. King, Holt, Spectroscopy and Molecular Structure, Rienehart and Winston 1964.
7. C.N.R. Rao, Spectroscopy in inorganic chemistry, Methven Co., London 1968.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER IV

CORE - IX ANALYTICAL CHEMISTRY – III

[75 Hours]

UNIT I ^{1}H NMR Spectroscopy (15 Hours)

Nuclear Magnetic Resonance Spectroscopy – Theory, spin – spin relaxation, spin – lattice relaxation and saturation processes. Environmental effects, instrumentation – type of magnets, source, detector, sample handling, application of photon NMR, qualitative and quantitative analysis. FT- NMR, Lanthanide compounds as shift reagents.

UNIT II ^{13}C NMR Spectroscopy (15 Hours)

^{13}C NMR spectroscopy – Comparison of ^{1}H and ^{13}C NMR, factors affecting intensity of signals, chemical shifts, Factors affecting the chemical shift. Broadband and off resonance decoupling MRI spectra. Hetero nuclear NMR basic (ideas). Applications of ^{13}C NMR in qualitative and quantitative analysis.

UNIT III Electron Spin Resonance Spectroscopy (18 Hours)

ESR : Line shapes and line width. The 'g' values – shift in g values. Factors affecting the magnitudes of g and A tensors in metal species – zero field splitting and Kramer's degeneracy – spectra of V(II), Mn(II), Be(II), Co(II), Ni(II) and Cu(II) complexes – applications of EPR to a few biological molecules containing Cu(II), Fe(II) and Fe(III) – John-Teller distortions in Cu (II) complexes.

UNIT IV Mass Spectra (18 Hours)

Principles of mass spectrometry– cyclotron resonance analyzer and Fourier transform mass spectrometers.

Presentation and analysis of spectra. Determination of molecular formulae. Nitrogen rule. Isotope abundance analysis of metastable ions and peaks – the molecular ion peak.

Fragmentation processes. Symbolism (scission only) even and odd electron ions. Scission with rearrangement. Retro – Diels Alder rearrangement. McLafferty rearrangement.

UNIT V Mossbauer and NQR Spectroscopy (18 Hours)

Principle – Doppler effect – isomer shift – electron – neutron hyperfine interactions, Quadrupole interactions and magnetic interactions, simple applications to Iron and Tin compounds.

NQR spectroscopy: Theory of NQR – instrumentation – nuclear quadrupole coupling constants – applications of NQR spectra to simple inorganic molecules.

TEXT BOOKS

1. A.I. Vogel, Text Book of Quantitative Inorganic Analysis, ELBS III and IV Edn.
2. William Kemp, Organic Spectroscopy, ELBS, II Edition, Spectroscopy of organic compounds.
3. P.S. Kalsi, Organic Spectroscopy, Wiley Eastern Ltd., Madras.
4. C.F. Banwell, Fundamentals of Molecular Spectroscopy, McGraw Hill, New York, 1966.

REFERENCE BOOKS:

1. J. Dyer, Application of absorption spectroscopy of organic compounds, Prentice Hall of India Pvt. Ltd., New Delhi.
2. R.M. Silverstein, C.G. Bassler and Monsil, Spectrometric identification of organic compounds, John Wiley & Sons, New York.
3. G.M. Barrow, Introduction to Molecular Spectroscopy, McGrawHill, New York, 1962.
4. W. Kemp, NMR in Chemistry, MacMillan Ltd, 1986.
5. G.W. King, Spectroscopy and Molecular Structure, Holt, Rienehart and Winston, 1964.
6. Raymond chung Basic Principles of Spectroscopy, McGraw Hill Ltd,

   New York.
7. Willard, Merit Dean and Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, IV Edn. 1986.
8. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub. Co, III Edn, 1985.
9. A.I. Vogel, Text Book of Quantitative Inorganic Analysis, ELBS III & IV Edn.
10. D.N. Sathyanarayana, Spectroscopy, New Age Publishers.. Smith, Heterocyclic Chemistry, Van Notrand Reishord Co., London, 1978.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER IV
ELECTIVE PAPER - IV - ANALYSIS OF MATERIALS
[75 Hours]

UNIT I Sampling **(15 Hours)**

Preparing the sample for analysis: The effect of sampling uncertainities, gross sample, determination of the size of the sample, analytical sample.

Sampling of solids – Preparation of laboratory sample from gross sample, moisture in the sample, sampling of gases and liquids.

Decomposition and dissolving the sample – Decomposition of sample by fluxes, wet digestion, dry ashing, combustion with oxygen, microwave decomposition.

UNIT II Biological Sample **(15 Hours)**

Composition of blood – collection and presentation of samples. Clinical analysis – Serum electrolytes, blood glucose, blood urea, nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphatases.

Drug analysis – Narcotics and dangerous drugs. Classification of drugs – screening by gas and thin layer chromatography and spectrophotometric measurements.

UNIT III Fertilizers, Pesticides, Soil and Water **(15 Hours)**

Fertilizer analysis : Analysis of nitrogen and mixed fertilizers.

Pesticides – Analysis of organophosphorous pesticides and their degradation products.

Soil moisture, pH, total nitrogen, phosphorous, silica, sulphur, manganese and other metals in soil.

Water and sewage analysis.

UNIT IV Industrial Samples **(15 Hours)**

Fuel and Gaseous fuels – sampling procedure, ultimate and proximate analysis, specific volatile index, ash content, calorific value by bomb calorimeter, and junker's calorimeter.

Liquid fuels – Flash point, viscosity, carbon residue, aniline point, pour point etc.,

Gaseous fuels – Analysis of producer gas, water gas and industrial gases. Chemical and physical methods of analysis.

Ore and cement analysis – Oxides, sulphides and carbonate ores, one/examples of each cement, silicate and glass.

UNIT V Food and Food Additives **(15 Hours)**

Food analysis – Moisture, ash, crude, protein, fat crude, fibre, carbohydrates calcium, potassium, sodium and phosphate. Food adulteration, common adulterants in food, contamination of foodstuffs. Microscopic examination of foods for adulterants.

Chemical and instrumental analysis of food additives – Preservatives, Food colorants, antioxidants, sweeteners, stabilizers, thickeners, clarifying and bleaching agents.

TEXT BOOKS

1. I.G. Harge, Analytical Chemistry Principles and Techniques, Prentice Hall.
2. G.D. Christan, Analytical Chemistry, J. Willey,
3. A.I. Vogel, Text Book of Quantitative Inorganic Analysis, ELBS III and IV Edn.
4. Alka L. Gupta, Analytical Chemistry, Pragati Edn., 2006.
5. H. Kaur, Instrumental Methods and Chemical Analysis, Pragati Edn., 2006.

REFERENCE BOOKS:

1. J.H. Kennedy, Analytical Chemistry Principles and Techniques,

   W.B. Saunders.
2. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub. Co, III Edn., 1985.
3. G.W. Ewing, Instrumental Methods of Chemical Analysis, McGraw Hill Pub. 1975.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER IV
CORE PRACTICAL - IV
ANALYTICAL CHEMISTRY PRACTICAL – I
(CONDUCTOMETRIC EXPERIMENTS)

1. Determination of equivalent conductance of a weak acid at different concentrations and verify Ostwald's dilution law and calculation of the dissociation constant of the acid.
2. Determination of equivalent conductivity of a strong electrolyte at different concentrations and examine the validity of the Onsager's theory as limiting law at high dilutions.
3. Conductometric titrations of a mixture of HCl and CH3COOH against Sodium hydroxide.
4. Compare the relative strength of acetic acid and monochloroacetic acid by conductivity method.
5. Determination of the activity coefficient of an electrolyte at different molalities by emf measurements.
6. Determination of the dissociation constant of acetic acid by titrating it with sodium hydroxide using quinhydrone as an indicator electrode and calomel as a reference electrode.
7. Determination of the strength of a given solution of KCl using differential potentiometric titration technique.
8. Determination of the PH of the given solutions with the help of the indicators using buffer solutions and by colorimetric method.
9. Determination of the PH of a given solution by emf method using hydrogen electrode and quinhydrone electrode.
10. Determination of the formation constant of silver ammonia complex and stoichiometry of the complex potentiometrically.
11. Solubility and solubility products by emf method.
12. Determination of the activity coefficient of Zinc ions in the solution of 0.002M Zinc sulphate using Debye - Huckel Limiting law.
13. Determination of solubility product of Silver bromide and calculate its solubility in water and 0.1 M and 0.01 M KBrO3 using Debye- Huckel limiting law.
14. Determination of the electrode potentials of Zn and Ag electrodes in 0.1 M and 0.001M solutions at 298 K and find the standard potentials for these electrodes and test the validity of Nernst equations.
15. Determination of Hardness of water by titrimetric method.
16. Determination of COD and BOD.
17. Determination of pH – pk1 and pk2 of dibasic acids (Oxalic acid)
18. Determination of E ½ potentials of metal ions by polarography.

M.Sc. ANALYTICAL CHEMISTRY
SEMESTER IV
CORE PRACTICAL - V
ANALYTICAL CHEMISTRY PRACTICAL – II

I ORGANIC ESTIMATION

Estimation of the following organic compounds:

1. Phenol
2. Aniline
3. Methyl Ketone
4. Glucose
5. Iodine value of an oil
6. Saponification value of an oil

II EXTRACTION OF NATURAL PRODUCTS

1. Caffeine from tea leaves.
2. Citric acid from lemon.

III CHROMATOGRAPHIC SEPARATIONS

1. Column chromatography : separation of a mixture of ortho and para-Nitroanilines.
2. Thin layer – Chromatography: separation of a mixture of ortho and para – Nitroanilines.
3. Paper chromatography – identification of natural alpha amino acids.

IV Quantitative analysis of complex materials

A) Quantitative analysis:

Quantitative analysis of the following mixture

1. Iron and magnesium
2. Iron and nickel
3. Copper and nickel
4. Copper and Zinc

B) Analysis of Ores

1. Determination of percentage of calcium and magnesium in dolomite.
2. Determination of percentage of MnO_2 in pyrolusite
3. Determination of percentage of lead in galena.

C) Analysis of Alloys

1. Determination of tin and lead in solder
2. Determination of copper and zinc in brass.
3. Determination of Chromium and nickel in stainless steel.

REFERENCE BOOKS:

1. G. Svehla, Vogel's Practical organic chemistry, ELBS, IV Edition 1985.
2. Vogels's Qualitative Inorganic analysis, VI Edition, orient Longmax (1987).
3. J. Basset, R.C. Denney, G.H. Jeffery and J. Mendham, Vogel's Text book of quantitative inorganic Analysis, ELBS, IV Edition. 1985.
4. W.G. Palmer, Experimental Inorganic Chemistry, Van Nostrand Reinhold Co., London. 1972.
5. D.N. Grindley, An advanced course in practical Inorganic Chemistry, Butterworths 1964.
6. J.N. Gurtu & Gurtu, Advanced Physical chemistry experiments, Pragati Publishers, 2006.

M.Sc. ANALYTICAL CHEMISTRY

SEMESTER IV

CORE PRACTICAL - VI

ANALYTICAL CHEMISTRY PRACTICAL – III

I. CHROMATOGRAPHIC TECHNIQUES

1. Column chromatography – Separation of chlorophyll
2. Thin layer chromatography – Separation of cation and anions, dyes in ink.
3. Paper chromatography – Separation of cations
4. Ion-exchange chromatography – Separation of Zn and Mg Separation of Cd and Zn.
5. Ring – oven Technique – Separation of cations and inorganic complex.

II. FLAME PHOTOMETRY

1. Determination of sodium, potassium and calcium.
2. Determination of potassium in combined fertilizer.
3. Determination of calcium in wine.

III. NEPHELOMETRY

1. Determination of sulphate.
2. Determination of halides

IV. BIAMPEROMETRY & BIPOTENTIOMETRY

1. Iodine – hypo titration
2. Fe(II) vs. Ce (IV) titration
3. Estimation of nitrite
4. Determination of copper.

V POLARIMETRY

1. Study the inversion of cane sugar in presence of acid.

VI. SPECTROPHOTOMETRY

1. Determination of Iron/Cobalt.
2. Determination of dissociation constant of an indicator
3. Determination of binary mixture
4. Determination of Mn in steel.