

**DANTULURI NARAYANA RAJU COLLEGE(AUTONOMOUS)**

(A College with Potential for Excellence)

Bhimavaram, W.G.Dist, A.P

Syllabus for the Academic Year 2018-19

Department: P.G.ANALYTICAL CHEMISTRY

Paper: GENERAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Wave equation-interpretation of wave function-properties of wave function-Normalisation and orthogonalisation  |
| Operators-Linear and Non linear ,Commutators of Operators  |
| Postulates of Quantum mechanics,Setting up of operators obserbables  |
| Hermitian operator-Eigen values of hermitian operator  |
| Basic quantum chemistry-II; Wave mechanics of simple systems with constant potential energy ,partical in one dimensional box .   |
| Factors influencing color transition –dipole integral , symmetry arguments in deriving the selection rules.  |
| Wave mechanics of systems with variable potential energy –symple harmonic oscillator , solution of wave equation-selection rules.  |
| Molecular spectroscopy-I;Rotational spectra of diatomic molecules-Rigid rotor Selection rules-calculation of bond length –isotopic effect,second order stark effect and its applications |
| Infrared spectra of diatrym molecules , harmonic and anharmonic oscillators –selection rules.  |
| Overtones combination bands – calculation of force constant , anharmonicity constant and zero point energy.  |
| Fermi resonance ,simultaneous vibration-rotation spectra of diatomic molecule .  |
| Molecular spectroscopyII-Raman effect –classical and quantum mechanical explanations   |
| Franck Condon principle –applications ,Rotational fine structure . Charge transfer spectra-band head and band shading  |

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Department : P.G.ANALYTICAL CHEMISTRY

Paper :GENERAL CHEMISTRY

Class: I M.SC ANALYTICAL CHEMISTRY

Semester:II

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|---|
| Basic Quantum chemistry III-Hydrogen atom ,probability density in orbitals ,shapes of orbitals .  |
| Perturbation theory- line independent perturbation theory Only first order perturbation is to be dealt with   |
| Application to ground state energy of Helium atom . Variation principle –Application –Calculation   |
| Molecular symmetry and group theory in chemistry, basic concepts of symmetry and group theory- symmetry elements.                                     |
| Symmetry operations and point groups, classification of molecules in to point groups.   |
| Group theory – group multiplication table for C <sub>2v</sub> and C <sub>3v</sub> point groups.   |
| Representations, reducible and irreducible representations, Mulliken symbols, orthogonality theorem and its implications                              |
| Treatment of analytical data, classification of errors, determinations of indeterminate errors, minimisation of errors- absolute and relative errors, |
| Standard deviations- standard error of mean – student' t-test, testing for significance – comparison of two means – f –tes.                           |
| Introduction to computer programming – basic structure and functioning of computer with pc as an illustrative examples.                               |
| Main memory – secondary storage memory – in put, out put devices  |
| Computer languages operating systems – principles of algorithms and flow charts.  |
| Arithmetic expressions – arithmetic statements- replacement statements – IF statements.   |
| Logical IF and block IF statements – GOTO statements, subscripted, variable and DIMENSION statement   |
| DO statement – rules for DO statements, functions and subroutines-development of FORTRAN statements for simple formula in chemistry.                  |
| Nernst equation, pH of solution – first order rate equation – cell constant – electrode potential.  |

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Syllabus for the Academic Year 2018-19

**Department:P.G.ANALYTICALCHEMISTRY**

**Paper: Inorganic chemistry-I**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:I**

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| Structure & Bonding:Application of VSEPR ,Valence bond theory and applications.   |
| Molecular orbital theories,Structure of Simple molecules.   |
| Applications of MO theory to Square planar &Octahedral complexes.   |
| Walsh diagram for water molecule.   |
| Coordination compounds;Crystal field theory- Crystal field splitting patterns in octahedral,tetrahedral,tetragonal ,square planar,trigonal bipyramidal geometries.                  |
| Calculations of CFSE, Factors affecting crystal field splitting energies ,spectrochemical series .  |
| Jahn-Teller effect, Nephelauxetic effect, ligand field theory .   |
| Term symbols –Russell sanders coupling, derivation of term symbols for various configurations .Spectroscopic ground states.   |
| Inorganic cage and ring compounds; Preparation ,structure and reactions of boranes , carboranes.  |
| Preparation , structure and reactions of metallocarboranes ,boron-nitrogen cyclic compounds .   |
| Phosphorus-nitrogen and sulphur- nitrogen cyclic compounds .  |
| Electron counting in boranes –Wades rules.Isopoly and Heteropoly acids.   |
| Electronic spectra of transition metal complexes;Selection rules ,break down of selection rules Orgel diagrams,T-S diagrams for $d^1$ - $d^9$ Octahedral and tetrahedral complexes. |
| Charge transfer spectra , Quenching of orbital momentum .   |

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**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper; INORGANIC CHEMISTRY-II**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:II**

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|---|
| Metal cluster compounds –Definition –evidences for existence of M-M bonds conditions favourable for formation of M-M bonds  |
| Classification of binuclear cluster compounds ,Confacial bioctahedron structures  |
| Trinuclear cluster compounds and polynuclear cluster compounds  |
| Polyatomic clusters –Zintl ions,chevreton phases.   |
| Organo metallic compounds :16 and18 electrons rules, isolobal relationship  |
| Iso electron relationship- synthesis structure and bonding of carbonmonoxide dinitrogen and nitricoxide complexes.  |
| Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.  |
| Classification metal carbonyls.   |
| Metal ligand equilibrium in solution: step wise and overall formation constants, factors effecting the stability metal complexes.                                     |
| Pearsons theory of hard and soft acids and bases, chelate effect, determination of stability constant.  |
| Inert and labile complexes, explanation of lability on the basis of VBT and CFT.biological and abiological nitrogen fixation.   |
| Metallo porphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to $Ca^{+2}$ . |
| Inorganic reaction mechanisms:ligand replacement reactions of metal complexes, acid hydrolysis- factors effecting acid hydrolysis.                                    |
| Acid and base hydrolysis of cobalt (III)complexes, ligand displacement reactions of square planar complexes of Pt(II).  |
| Factors effecting square planar substitutions – trans effect, complementary and non complementary reactions with examples.  |
| Electron transfer reactions of complexes- inner and outer sphere mechanisms.  |

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Department : P.G.ANALYTICAL CHEMISTRY

Paper :ORGANIC CHEMISTRY-I

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:I

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| Nature of bonding in organic molecules and aromaticity:a)electronic effects and reactive intermediates: inductive effect, mesomeric effect, hyper conjugation, steric effect, tautomerism..  |
| Acidity and basicity of organic molecules, generation, structure, stability and reactivity of carbo cations, carbanions, carbon free radicals, nitrenes and arynes.  |
| Criteria of aromaticity: the energy , structure and electronic, criteria, for aromaticity relationship among the energetic, structural and electronic criteria of aromaticity.   |
| Huckles rule and MO theory, aromaticity in benzeneoid and nonbenzenoid compounds, aromaticity in charged and fused ring systems, hetero aromatic systems.  |
| Annulenes :cyclo butadiene, benzene, 1,3,5,7-cyclo tetraene, [10],[12],[14],[16] and[18] annulenes, azulenes fulvenes, fullerenes, ferrocene, anti aromaticity and homo aromaticity.   |
| Stereo chemistry and molecular representation of organic molecules:a)molecular symmetry and chirality:symmetry elements, definition and classifications of stereo isomers, enantiomers, diastereomers,invertomers,homomers,epimers, anomer, configuration and conformation configurational nomenclature.   |
| D,L and R,S nomenclature, molecules with a single chiral centre: tetra and tri coordinate chiral centre,molecules with two or more chiral centres, constitutionally unsymmetrical molecules.b)geometrical isomerism and conformations of cyclic systems:cis-trans, E,Z-and syn and anti nomenclature.  |
| Methods of determining configuration of geometrical isomers using, physical, spectral and chemical methods, stability, cis-trans inter conversion. Conformations of cyclo butane, cyclo pentane, cyclo hexane, mono and disubstituted cyclo hexanes  |
| Prochirality&prostereomerism:homotopic ligands faces&faces,enantiotopic ligands&faces,diastereotopic ligands&faces.d)stereoisomerism in molecules without chiral center-axial chirality allenes,alkylidene cycloalkanes,spiranes,atropisomerism:biphenyl derivatives,nomenclature. planar chirality:ansa compounds,paracyclophanes,trans-cyclooctene&helicity. |
| Heterocyclic compounds:importance of heterocyclic compounds as drugs,nomenclature of heterocyclic systems based on ring size,number&nature of heteroatoms.   |
| Chemistry of heterocyclic compounds,synthesis&reactivity of the following systems:quinoline,isoquinoline,indole,pyrazole,imidazole,oxazole.  |
| Chemistry of heterocyclic compounds,synthesis&reactivity of the following systems:isoxazole,pyridazine,pyrimidine&pyrazine   |
| Chemistry of some typical natural products(alkaloids and terpenoids) isolation, structural elucidation, synthesis and biogenesis of alkaloids: atropine, nicotine, quinine.  |
| isolation, structural elucidation, synthesis and biogenesis of terpenoids: alpha – terpineol, alpha pinene and camphor.  |

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Department :P.G.ANALYTICAL CHEMISTRY

Paper :ORGANIC CHEMISTRY-II

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:II

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| Aliphatic & aromatic nucleophilic substitution: stereochemistry of SN2 & SN1 mechanisms, neighbouring group participation, NGP by O, S, N  |
| aromatic nucleophilic substitution: SN2 (Ar) (addition-elimination), SN1 (Ar) and benzyne mechanisms (elimination-addition), evidence for the structure of benzyne.  |
| Von Richter, Sommelet-Hauser, Smiles rearrangement. Elimination reaction: type of elimination reactions, mechanisms, stereochemistry and orientations.   |
| Hofmann and Saytzeff rules. Syn eliminations vs anti elimination, competition between elimination and substitutions, dehydration, dehydrogenation, dehalogenation, decarboxylative elimination and pyrolytic eliminations. |
| Addition reactions: a) addition to C-C multiple bonds: mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radical, region and chemo selectivity.                  |
| Orientation and reactivity, hydrogenation of double and triple bonds, hydrogenation of aromatic rings, hydroboration.  |
| Addition to Carbon-hetero multiple bonds: steric course of addition reactions to C=O and C=N, aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt.   |
| Claisen, Dieckmann, Benzoin and Stobbe condensation, Reformatsky reaction, Tolens, Prins reactions; Wittig, Grignard, Mannich and Michael reaction, hydrolysis of carbon nitrogen bond isocyanates and isothiocyanates.    |
| Molecular rearrangements: types of molecular rearrangement, migratory aptitude. Rearrangement to electron deficient carbon: pinacol-pinacolone, Wagner-Meerwein, Tiffeneau-Demjanov.                                       |
| Dienone-phenol, Arndt-Eistert synthesis. Rearrangement to electron deficient nitrogen: Beckmann, Hofmann, Curtius rearrangement.   |
| Schmidt and Lossen rearrangement. Rearrangements to electron deficient oxygen: Baeyer-Villiger, hydroperoxide rearrangement and Dakin rearrangement.   |
| Neber rearrangement, benzil-benzilic acid and Favorskii rearrangement. Spectroscopy and protecting groups: basic principle and importance of UV.   |
| Basic principle and importance of IR.  |
| Basic principle and importance of NMR.   |
| Basic principle and importance of Mass.  |
| Protection of carbonyl, hydroxyl, carboxylic and amine groups.   |

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Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-I

Class:I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Thermodynamics:concepts of partial molar properties, graphical methods, intercept method and apparent molar volume method.   |
| Chemical potential with T&P Gibbs Duhem equation phase rule from the concept of chemical potential, thermodynamic properties of ideal solutions.   |
| Raoult's law, Henry's law, non ideal systems, concept of fugacity, non ideal solutions, activities and activity coefficients.  |
| Determination activity coefficient from vapour pressure measurement, chemical equilibrium, effect temp on equilibrium constant, Vant hoff equation.  |
| Micelles and macro molecules: classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration.  |
| Factors affecting CMC, thermodynamics of micellization , phase separation and mass action models, solubilization, micro emulsions, reverse micelles.   |
| Polymers, types of polymers, electrically conducting polymer, liquid crystal polymers, kinetics of free radical polymerization, molecular mass number and mass average molecular weight.                     |
| Weight determination - end group analysis, osmometry, viscometry, light scattering methods.  |
| Chemical kinetics, collision theory, transition state theory Debye Huckel theory, salt effects.  |
| Hammett equation, Taft equation, consecutive reactions, parallel reactions, opposing reactions.  |
| Acid -base catalysis, Arrhenius diagram, fast reactions flow methods.  |
| Photochemistry: Franck Condon principle, excited molecules, singlet and triplet states, spin orbit interactions, actinometry, ferrioxalate and uranyl oxalate actinometers - problems.                       |
| Derivation of fluorescence and phosphorescence, quantum yields, quenching effect, Stern Volmer equation.   |
| Photochemical equilibrium and delayed fluorescence- E type and P type, photochemical primary process, types of photochemical reactions, photodissociation, additional isomerisation reactions with examples. |

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Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-II

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:II

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| NMR-Principle and Theory Introduction.  |
| Nature of spinning particle and its interaction with magnetic field.Chemical shift&origin spin-spin interaction,Application of NMR to structural elucidation.               |
| Electron spin resonance-principle and experimental technique –g-factor,Line shapes&Line widths hyperfine interactions.  |
| Applications of ESR studies.  |
| Brief review on Entropy changes accompanying specific process-expansion,phase transition,heating measurement of Entropy.  |
| Nernst heat theorem,Third law of thermodynamics-Determination of the absolute entropy.  |
| Types of ensembles,thermodynamic probability,most probable distribution law –partition function,molar&molecular partitions.   |
| Rotational,translational,vibrational&electronic partition function –relation between thermodynamic function (E,H,S,G&Cv)and the partition functions.                        |
| Electrochemistry-Electrochemical cell –Galvanic&Electrolytical cell.Concentration cell with&without transference,effect of complexation on redox potential.                 |
| Ferricyanide\ferrocyanide couple,Iron(III) phenonthroline/Iron(II) phenonthroline couple.   |
| - Ferricyanide\ferrocyanide couple,Iron(III)  |
| Determination of standard potential,solubility product equilibrium constant&activity coefficients from EMF data.  |
| Bjerrum theory of ion association concept of activity and activity coefficients in electrolytic solutions.  |
| The mean ionic activity coefficient,Debye-Huckel theory of electrolytic solutions,Limiting law.   |
| Calculation of mean ionic activity coefficient,limitations of Debye-Huckel theory.  |
| Effect of dilution on equivalent conductance of electrolytes,anomalous behavior of strong electrolyte.Debye-Huckel Onsagar equation-varification and limitations,fuel cell. |
| Electrochemistry-II the electrode-electrolyte interface.  |
| The electric double layer.The Helmholtz-Perrin parallel-plate model,The Gouy-chapman diffuse-charge model&the stern model.  |



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Department :P..G.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-I

Class: II MSC ANALYTICAL CHEMISTRY

Semester:III

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| Classification different chromatographic methods, theory of chromatography, development techniques elution, gradient elution, displacement and frontal analysis |
| Chromatography phenomena migration, adsorption, partition adsorption coefficient retardation factor, retention time and volume.                                 |
| Partition isotherms, zone spreading, column capacity, temp effects, efficiency of chromatography column.  |
| HETP, Vandemeter equation resolution choice of column length, flow velocity, qualitative and quantitative analysis.   |
| Principle of column chromatography adsorption isotherms chromatographic media nature of forces between sample and stationary phase.                             |
| Column chromatography without detectors and liquid chromatography with detectors and application.   |
| Principles of gel exclusion chromatography properties of xerogels apparatus and detectors resolution.   |
| Principles of capillary electrophoresis, instrumentation applications to inorganic and organic compounds.   |
| Gas chromatography principle Instrumentation, columns detectors thermal conductivity, flame ionization electron capture,N-P detector.                           |
| Photo ionization, temp programming of G.C and applications structure of zeolites crystals types of sieved.  |
| Application in the separation of gases including hydrocarbons ion exclusion principles and applications.  |
| Affinity chromatography principle and applications, GC-MS Principle and instrumentation and applications of GC-MS   |
| Liquid-liquid partition chromatography principle, supports partition liquids, eluents, reverse phase chromatography apparatus applications, HPLC theory.        |
| HPL instrumentation, columns UV detector, RF detector, Fluorescence, diode array detector, .applications in the separation of organic compounds.                |
| Applications in the separation of organic compounds, names of other detectors used their principles and applications.   |
| LC-MS principle and instrumentation LC-MS data ion Chromatograms, selected ion monitoring.  |
| Processing LC-MS data, ion chromatograms, library searching quantitative measurements.  |

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Department :P..G.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-I I

Class:II MSC ANALYTICAL CHEMISTRY

Semester:IV

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| Paper chromatography principle, chromatographic medium, modified papers, solvent, systems mechanism of paper chromatography, experimental technique different development methods.   |
| Desending, horizontal circular spreading multiple development, two dimensional development, reverse phase chromatographic technique visualization chromatograms.   |
| Thin layer chromatography principle, media coating materials, applications simple development, solvent systems development of chromatoplate types of development of chromatoplate types of development visualization methods documentation applications in the separation HPTLC principle, technique applications. |
| Ion exchange chromatography principles systematic ion exchange resins properties of anion and cation exchange resin, ion exchange mechanism equilibria, selectivity, ion exchange capacity, applications of ion exchangers.  |
| In different fields, principles of ion exchange systems, equipment application specifically separations of lanthanides, actinides, amino acids , Ion chromatography principles of separation instrumentation, detectors.   |
| Separation of cations and anions applications in the analysis of water and air pollutants,. Basis of sampling, purpose of sampling homogenous and heterogeneous samples.   |
| Statistical criteria for good sampling sample size sampling unit, gross sample, Laboratory sample, sampling of solids, cone and quartering method.   |
| Long pile and alternative shovel method, precautions in preservation of solid samples, sampling of metals and other solids rods wires, sheets, plates especially gold, silver, iron and other metals.  |
| Sampling of different types of liquids and techniques, sampling of drinking water industrial effluents..   |
| precautions in sampling and preservation of collected liquids.   |
| Sampling of gases and preconcentration by adsorption or absorption method instantaneous monitoring, precautions.   |
| In preservation of samples, systematic sampling and random sampling importance of analytical chemistry   |
| To industrial research and development industries and other branches of science, development and validation of an analytical method.   |
| Units concentrations calculations, standards, chemical reactions, importance of separation methods with examples. principles and processes of solvent extraction, distribution law and partition coefficient, nature of partition forces.  |
| Different types of solvent extraction , solvent extraction systems, applications in metallurgy, general application in analysis and pre- concentration.  |
| Special extraction systems like crown ethers, super fluid and surfactant extractions- examples.  |

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Department: P.G.ANALYTICAL CHEMISTRY

Paper:QC&Traditional Methods of Analysis-I

Class:II M.Sc.Analytical Chemistry

semester:III

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| Classification of functional groups with suitable examples,Determination of functional groups imparting acidic nature-Thiol,Endiol.   |
| Determination of imparting acidic nature-Phenolic hydroxyl.Determination of imparting basic nature Aliphatic&Aromatic amines.Difference b/w Aliphatic and Aromatic Amines.                |
| Determination of Primary,Secondary,Tertiary Amines&Hydride derivatives.   |
| Functional groups which imparting neither acidic nor basic nature-Aldehydes,Ketones,Nitro group,Methoxy,Aliphatic group.  |
| Characteristics of an analysis-LOD,Sensitivity,Safety,Cost measurability,Selectivity&Specificity.   |
| Classification of errors,minimization of errors,ISO 9000 series,ISO 14000 series.   |
| Good laboratory practices&ICH guide lines on drug substances&products,control charts.   |
| Accuracy,precision,significant figures,normal distribution,F-test   |
| Oxidant systems-Principles &Applications in Analysis-Inorganic systems Mn(III),Mn(VII),Ce(IV),Cr(VI)is determined.  |
| Determination of Inorganic systems V(v),Periodate,Iodate.Organic systems Chloramine-T.Oxidant properties and indicators.  |
| Organic compounds Principles of solubility of organic compounds,Non polar,Polar solvents.Recrystallisation method and applications of solubility and recrystallisation.                   |
| Inorganic compounds definition of dissolution &decomposition.Principles of decomposition &dissolution,difference b/w Dissolution&decomposition. Decomposition with H <sub>2</sub> O,HCl . |
| Decomposition with HF,HNO <sub>3</sub> ,H <sub>2</sub> SO <sub>4</sub> &HClO <sub>4</sub>   |
| Definition of fusion &Sintering.Difference b/w fusion & sintering &fusion with sintering with decomposition with examples.  |
| Decomposition techniques and parameters needs to be consider in the decomposing the samples for Analysis.   |
| Absorption of microwave energy and heating .Explain the ultrasonic assisted extraction.   |
| Statistical analysis –Mean deviation,standard deviation,coefficient of variance,T-test,Ruggedness test,Youden plot,Ranking test.  |
| Computations and propagation of errors representation of data,production and service elements of quality assurance,quality and quantity management system ,control tools.                 |

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Department:P.G.ANALYTICAL CHEMISTRY

Paper:Traditional Methods of Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Precipitation methods-I:crystal habit &super saturation,nucleation and crystal growth,homogeneous&heterogeneous nucleation,solubility and particle size,colloids,completeness of precipitation                    |
| Effect of excess precipitant,ph,complex formation,temperature,purity of precipitates,aging.Co-precipitation & post precipitation:theory of adsorption of salts having an ion in common with the main precipitate. |
| Co-precipitation in colloidal precipitates,adsorption of solvents,mixed crystal formation by occlusion and entrapment,re-precipitation with examples,post-precipitation-theory of post-precipitation              |
| Examples of post precipitation,conditions for obtaining pure and quantitative precipitates.Precipitation titrations:principle,indicators for precipitation titrations,determination of halides.                   |
| Precipitation from homogeneous solution(PFHS):theory of PFHS,methods of PFHS-increase in pH,decrease in pH,cation release,anion release,reagent synthesis.  |
| Change in oxidation state,photochemical reactions,precipitation from mixed solvents,applications of PFHS methods.Gravimetric determinations:nature of species,preparation of solutions,limitations.               |
| Interferences,inorganic precipitants-chloride and sulphates,organic precipitants dimethyl glyoxime ,oxime,benzidine,salicyladoxime,benzoic oxime,sodium tetraphenyl boron,tetraphenyl arsonium chloride.          |
| Electro-gravimetric analysis:principle,important terms in electrogravimetry,decomposition voltage or decomposition potential,over voltage and their importance,instrumentation,electrolysis at constant current.  |
| Determination of Cu(II) by constant current electrolysis,electrolysis at controlled potentials,determination of Cu,Pb,Sn in brass and bronze by controlled potential electrolysis.                                |
| Reductant system-principles and applications in analysis:analytical chemistry of some selected reductant systems-formal.  |
| Standard and normal potential in various media,stability of the solutions,species responsible for the reduction properties.   |
| Standardisation,requirement for the selection of the reductants,selection of suitable indicators for various reductants systems.  |
| Inorganic systems-Cr(II),V(II),Ti(III),Sn(II),Fe(II) in H <sub>3</sub> PO <sub>4</sub> and hydrazine.   |
| Organic systems-hydroquinone and ascorbic acid,Analysis of some selected drugs:basic considerations of drugs-classification.  |
| Determination of the following drugs:acetyl salicylic acid,testosterone progesterone,cortisone  |
| Determination of sulphadiazine,phenobarbitone   |
| Determination of chloramphenicol,benzyl penicillin and tetracycline,thiamine,riboflavin,ascorbic acid.  |
| Determination of Isoniazid,metyldopa,metronidazole.   |

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Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Intorduction of applied analysis, dissolution of complex materials various de chemical methods.<br>Introduction of iron ore.   |
| Determiration of iron ore, determination manganese ore.  |
| Analysis of chromite ore and analysis of phosphate rock ore.   |
| Analysis of aluminium ore , analysis of finished product-1, analysis of steel.   |
| Analysis of blast furnance slag, analysis of refractory materials.   |
| Analysis of fluxes, analysis finished product-2, analysis of cement.   |
| Analysis of oils and analysis of soaps.  |
| Analysis of paints, introduction of water quality, standards for drinking water.   |
| Source of water, classification of water for different uses.   |
| Types of water pollutants and their affects, analytical methods, the determination of anions like $\text{CO}_3^{-2}$ , $\text{HCO}_3^-$ , $\text{Cl}^-$ , $\text{F}^-$ |
| Analysis of anions $\text{SO}_4^{-2}$ , $\text{PO}_4^{-3}$ , $\text{NO}_3^-$ , $\text{NO}_2^-$ ,   |
| Determination of anions is cynide, sulphide, determination of cations like $\text{Fe}^{+2}$ , $\text{Fe}^{+3}$ $\text{Ca}^{+2}$ , $\text{Mg}^{+2}$ .                   |
| Determination of cations $\text{Cr}^{+3}$ , $\text{As}^{+5}$ .   |
| Determination of cations $\text{Pb}^{+2}$ , $\text{Hg}^{+2}$ , $\text{Cu}^{+2}$ .  |
| Determination of cations $\text{Zn}^{+2}$ , $\text{Cd}^{+2}$ , $\text{Co}^{+2}$ .  |
| Determination of D.O,B.O.D,C.O.D.  |
| Standards for drinking water, general introduction, uses and application of water quality.   |
| Saponification number,iodine number,acid number,diffirent uses for the assessment of water quality .   |

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Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-II

Class:II

M.Sc.Analytical Chemistry

Semester:IV

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| Introduction of analysis of raw materials,analysis of non-ferrous alloys,analysis of ferro alloys   |
| Analysis of brass,analysis of bronze,analysis of solder   |
| Analysis of ferro silicon constituents are si,c,p,s;analysis of ferro vanadium constituents are v,c,p,s,si,Al   |
| Analysis of ferro manganese,analysis of silico manganese  |
| Introduction of analysis of soils,fertilizers and fuel  |
| Analysis of soils:sampling,determination of moisture,total N,P,Si,lime,humus nitrogen,alkali salts,soil absorption ratio.   |
| Analysis of fertilizer:ammonical fertilizers,phosphate fertilizes,nitrate fertilizers   |
| Analysis of fuels:sold fuels-coal,proximate analysis,ultimate analysis,heating value,grading of coil based on ultimate heat value{UHV}  |
| Assessment oair quality:composition opure air,classification of air pollutants,toxic elements presents in dust and their sources  |
| Collection of air samples,sources,effects,control of pollution and chemical analysis for the following  |
| Primary pollutants:corbon compounds-(CO),carbon dioxide,sulphur compounds:sulphur dioxide,sulphur trioxide,hydrogen sulphide  |
| Nitrogen compounds:nitric oxide,nitrogen dioxide,hydrocarbons:-aliphatic hydrocarbons&polycyclic aromatic hydrocarbons  |
| Particulate matter-repairable&suspended particulate matter,inorganic&organic particulates   |
| Secondary pollutants-ozone,peroxy acetyl nitrate,peroxy benzyl nitrate;standards for amient air quality   |
| Kinetic methods of analysis:introduction,slow reactions,catalyzed reactions   |
| Methods of determination of catalyst concentration,extrapolation methods for the determination of catalyst,variable time method,fixed time method   |
| Examples for the determination of toxic metals and anions using some typical kinetic reactions.Non aqueous titrimetry:classification of solvents and titrations for non aqueous titrymetry. |
| Types of reactions-indicators:determination of acids,determination of bases,karl-fisher reagent for the determination of moisture content in drugs and other samples                        |

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Bhimavaram, W.G.Dist, A.P

Syllabus for the Academic Year 2018-19

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-I

Class:II M.Sc. ANALYTICAL CHEMISTRY

Semester:III

|   |
|---|
| Laws of absorption, deviations from beer's law, single and double beam, spectrometers.  |
| Instrumentation , sources of radiation detectors qualitative analysis by absorption measurements , general precautions in colorimetric determination,.  |
| Spectro photometric titrations, principle of diode array detector determination of $Fe^{+2}$ , and $Fe^{+3}$ .  |
| Determination of $Al^{+3}$ , $NH_4^+$ , $Cr^{+3}$ , $Cr^{+6}$ , $Co^{+3}$ , $Cu^{+2}$ , $Ni^{+2}$ , $NO_2^-$ , $PO_4^{-3}$ , Simultaneous determination of $KMnO_4$ and $K_2Cr_2O_7$ . Theory of fluorescence and phosphorescence, factors affecting these two, principle and instrumentation of Spectro Fluorimetry. |
| Units of frequency, wavelength, and wave number, molecular vibrations factors influencing frequencies, instrumentation of IR spectroscopy.  |
| Sampling techniques detectors in IR, qualitative and quantitative analysis with reference to selected molecules like CO and $CO_2$ .  |
| Non destructive IR method for the analysis of CO and other organic compounds, principle of FT-IR.   |
| Theory of Raman spectroscopy and instrumentation and Raman spectra of CO, $CO_2$ , $N_2O$ and $H_2O$ , Differences between Raman spectra and IR spectra.  |
| Resonance condition, Origin of NMR spectra, factors affecting chemical shift, shielding and de shielding.   |
| Spin-spin coupling, interpretation of NMR spectra of organic compounds factors influencing NMR spectra Fast chemical reactions  |
| Magnitude of I, nuclei with Quadrapole moments FT-NMR Study of isotopes other than proton $^{13}C$ $^{15}N$ , $^{19}F$ , $^{31}P$ , $^{11}B$ double resonance, shift reagents, Spin tickling and applications.  |
| Theory of ESR and instrumentation , g-value, hyperfine splitting qualitative analysis, Krammer's degeneracy.  |
| Instrumentation of ESR differences between ESR and NMR spectra. Qualitative analysis, study of free radicals and other applications.  |
| Mass spectroscopy principle and ion sources, inlets, detectors.   |
| Types of peaks, observed resolution qualitative analysis molecular weight determination   |
| Quantitative analysis, advantages chemical analysis of X-RF matrix effects, advantages of X-RF wave length, dispersive technique and evaluation methods.  |
| X-RF energy dispersive technique and evaluation method, applications.   |
| Instrumentation of X-RF, matrix effects, and its advantages.  |

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Syllabus for the Academic Year 2018-19

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-II

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:IV

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| Flame photometry theory, instrumentation, combustion flames, detectors, and analysis of Na, K ,Ca and Mg, atomic absorption spectrometer theory and instrumentation, flame techniques.   |
| Resonance line sources, hollow cathode lamp chemical and spectral interferences. applications with special reference to analysis of trace metal in oils, allows and toxic metals in drinking water and effluents.  |
| ICP-AES, ICP-MS principles, instrumentation of plasma, AES detectors, quadra-pole mass spectrometers, differences between the two detectors.   |
| Applications of liquids and solids, applications in the analysis of trace and toxic metals in water geological and industrial samples, arc and spark spectrographic direct analysis of solid for metals.   |
| Thermo Gravimetry theory, instrumentation and applications, with special reference to $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , $\text{CaCO}_3$ , $(\text{COOH})_2$ . differential thermal analysis- principle, instrumentation, difference between TG and DTA. |
| DTA-applications with special reference to the clays and minerals coals (fuels), differential scanning calorimetry - principle, instrumentation and applications to inorganic materials like chlorates and perchlorates  |
| Determination of ammonium nitrate organic compound and drugs by using DSC. Principle of Polarography, residual current, migration current ,diffusion current, half wave potential ILKOVIC equation and DME instrumentation.  |
| Advantages & disadvantages, qualitative and quantitative analysis of inorganic ions Cu, Bi , Pb,Cd and Zn. AC polarography, pulse polarography, Principle, instrumentation of HMDE   |
| Application in the analysis of Pb and Cd in environmental samples.   |
| Principle of cathode stripping voltametry principles of coulometric analysis with constant current coulometric analysis of cations- As(III),Fe(II).  |
| Determination $\text{I}^-$ and $\text{S}^{2-}$ by using $\text{I}_2$ liberations and $\text{Ce}^{+4}$ liberation in solutions coulometric analysis with controlled potentials.   |
| Reference electrodes- hydrogen electrode calomel electrode, silver chloride.   |
| Indicator electrodes- hydrogen electrode, glass electrodes, theory of membrane potentials and glass electrodes, theory of membrane potentials and liquid junction potentials, calibration of ion selective electrodes.   |
| Ion selective electrodes with fixed membrane sited Ag, Pb, Cd, S, F, CN and glass electrodes applications in the analysis of air and water.  |
| Detection and measurements of radio activity introduction to radioactive traces applications of tracer technique.  |
| Isotope dilution analysis applications activation analysis applications advantages disadvantages radio carbon dating technique.  |



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Syllabus for the Academic Year 2017-18

Department:P.G.ANALYTICAL CHEMISTRY

Paper: GENERAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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|---|
| Wave equation-interpretation of wave function-properties of wave function-Normalisation and orthogonalisation                     |
| Operators-Linear and Non linear ,Commutators of Operators   |
| Postulates of Quantum mechanics,Setting up of operators obserbables   |
| Hermitian operator-Eigen values of hermitian operator   |
| Basic quantum chemistry-II; Wave mechanics of simple systems with constant potential energy ,partical in one dimensional box .    |
| Factors influencing color transition –dipole integral , symmetry arguments in deriving the selection rules.                       |
| Wave mechanics of systems with variable potential energy –symple harmonic oscillator , solution of wave equation-selection rules. |
| calculation of bond length –isotopic effect,second order stark effect and its applications  |
| Molecular spectroscopy-I;Rotational spectra of diatomic molecules-Rigid rotor Selection rules-                                    |
| Infrared spectra of diatomic molecules , harmonic and anharmonic oscillators –selection rules.                                    |
| Overtone combination bands – calculation of force constant , anharmonicity constant and zero point energy.                        |
| Fermi resonance ,simultaneous vibration-rotation spectra of diatomic molecule .   |
| Molecular spectroscopyII-Raman effect –classical and quantum mechanical explanations  |
| Franck Condon principle –applications ,Rotational fine structure . Charge transfer spectra-band head and band shading             |

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Syllabus for the Academic Year 2017-18

Department : P.G.ANALYTICAL CHEMISTRY

Paper :GENERAL CHEMISTRY

Class: I M.SC ANALYTICAL CHEMISTRY

Semester:II

|   |
|---|
| Basic Quantum chemistry III-Hydrogen atom ,probability density in orbitals ,shapes of orbitals .  |
| Perturbation theory- line independent perturbation theory Only first order perturbation is to be dealt with   |
| Application to ground state energy of Helium atom . Variation principle –Application – Calculation  |
| Molecular symmetry and group theory in chemistry, basic concepts of symmetry and group theory-symmetry elements.                                      |
| Symmetry operations and point groups, classification of molecules in to point groups.   |
| Group theory – group multiplication table for C <sub>2v</sub> and C <sub>3v</sub> point groups.   |
| Representations, reducible and irreducible representations, Mulliken symbols, orthogonality theorem and its implications                              |
| Treatment of analytical data, classification of errors, determinations of indeterminate errors, minimisation of errors- absolute and relative errors, |
| Standard deviations- standard error of mean – student' t-test, testing for significance – comparison of two means – f –tes.                           |
| Introduction to computer programming – basic structure and functioning of computer with pc as an illustrative examples.                               |
| Main memory – secondary storage memory – in put, out put devices  |
| Computer languages operating systems – principles of algorithms and flow charts.  |
| Arithmetic expressions – arithmetic statements- replacement statements – IF statements.   |
| Logical IF and block IF statements – GOTO statements, subscripted, variable and DIMENSION statement   |
| DO statement – rules for DO statements, functions and subroutines-development of FORTRAN statements for simple formula in chemistry.                  |
| Nernst equation, pH of solution – first order rate equation – cell constant – electrode potential.  |

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Syllabus for the Academic Year 2017-18

**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-I**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:I**

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|---|
| Structure & Bonding:Application of VSEPR ,Valence bond theory and applications.   |
| Molecular orbital theories,Structure of Simple molecules.   |
| Applications of MO theory to Square planar &Octahedral complexes.   |
| Walsh diagram for water molecule.   |
| Coordination compounds;Crystal field theory- Crystal field splitting patterns in octahedral,tetrahedral,tetragonal ,square planar,trigonal bipyramidal geometries.                  |
| Calculations of CFSE, Factors affecting crystal field splitting energies ,spectrochemical series .  |
| Jahn-Teller effect, Nephelauxetic effect, ligand field theory .   |
| Term symbols –Russell sanders coupling, derivation of term symbols for various configurations .Spectroscopic ground states.   |
| Inorganic cage and ring compounds; Preparation ,structure and reactions of boranes , carboranes.  |
| Preparation , structure and reactions of metallocarboranes ,boron-nitrogen cyclic compounds .   |
| Phosphorus-nitrogen and sulphur- nitrogen cyclic compounds .  |
| Electron counting in boranes –Wades rules.Isopoly and Heteropoly acids.   |
| Electronic spectra of transition metal complexes;Selection rules ,break down of selection rules Orgel diagrams,T-S diagrams for $d^1$ - $d^9$ Octahedral and tetrahedral complexes. |
| Charge transfer spectra , Quenching of orbital momentum .   |

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Syllabus for the Academic Year 2017-18

**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-II**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:II**

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|---|
| Metal cluster compounds –Definition –evidences for existence of M-M bonds conditions favourable for formation of M-M bonds  |
| Classification of binuclear cluster compounds ,Confacial bioctahedron structures  |
| Trinuclear cluster compounds and polynuclear cluster compounds  |
| Polyatomic clusters –Zintl ions,chevreton phases.   |
| Organo metalliccompounds :16 and18 electrons rules, isolobal relation ship  |
| Iso electron relationship- synthesis structure and bonding of carbonmonoxide dinitrogen and nitricoxide complexes.  |
| Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.  |
| Classification metal carbonyls.   |
| Metal ligand equilibrium in solution: step wise and overall formation constants, factors effecting the stability metal complexes.                                     |
| Pearsons theory of hard and soft acids and basis, chelate effect, determination of stability constant.  |
| Inert and labile complexes, explanation of lability on the basis of VBT and CFT.biological and abiological nitrogen fixation.   |
| Metallo porphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to $Ca^{+2}$ . |
| In organic reaction mechanisms:ligand replacement reactions of metal complexes, acid hydrolysis- factors effecting acid hydrolysis.                                   |
| Anation and base hydrolysis of cobalt (III)complexes, ligand displacement reactions of square planar complexes of Pt(II).   |
| Factors effecting square planar substitutions – trans effect, complementary and non complementary reactions with examples.  |
| Electron transfer reactions of complexes- inner and outer sphere mechanisms.  |

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Syllabus for the Academic Year 2017-18

Department :P.G.ANALYTICAL CHEMISTRY

Paper :ORGANIC CHEMISTRY-I

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:I

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| Nature of bonding in organic molecules and aromaticity:a)electronic effects and reactive intermediates: inductive effect, mesomeric effect, hyper conjugation, steric effect, tautomerism..  |
| Acidity and basicity of organic molecules, generation, structure, stability and reactivity of carbocations, carbanions, carbon free radicals, nitrenes and arynes.   |
| Criteria of aromaticity: the energy, structure and electronic, criteria, for aromaticity relationship among the energetic, structural and electronic criteria of aromaticity.  |
| Huckles rule and MO theory, aromaticity in benzenoid and nonbenzenoid compounds, aromaticity in charged and fused ring systems, hetero aromatic systems.   |
| Annulenes :cyclo butadiene, benzene, 1,3,5,7-cyclo tetraene, [10],[12],[14],[16] and[18] annulenes, azulenes fulvenes, fullerenes, ferrocene, anti aromaticity and homo aromaticity.   |
| Stereo chemistry and molecular representation of organic molecules:a)molecular symmetry and chirality:symmetry elements, definition and classifications of stereo isomers, enantiomers, diastereomers,invertomers,homomers,epimers, anomer, configuration and conformation configurational nomenclature.   |
| D,L and R,S nomenclature, molecules with a single chiral centre: tetra and tri coordinate chiral centre,molecules with two or more chiral centres, constitutionally unsymmetrical molecules.b)geometrical isomerism and conformations of cyclic systems:cis-trans, E,Z-and syn and anti nomenclature.  |
| Methods of determining configuration of geometrical isomers using, physical, spectral and chemical methods, stability, cis-trans inter conversion. Conformations of cyclo butane, cyclo pentane, cyclo hexane, mono and disubstituted cyclo hexanes  |
| Prochirality&prostereomerism:homotopic ligands faces&faces,enantiotopic ligands&faces,diastereotopic ligands&faces.d)stereoisomerism in molecules without chiral center-axial chirality allenes,alkylidene cycloalkanes,spiranes,atropisomerism:biphenyl derivatives,nomenclature. planar chirality:ansa compounds,paracyclophanes,trans-cyclooctene&helicity. |
| Heterocyclic compounds:importance of heterocyclic compounds as drugs,nomenclature of heterocyclic systems based on ring size,number&nature of heteroatoms.   |
| Chemistry of heterocyclic compounds,synthesis&reactivity of the following systems:quinoline,isoquinoline,indole,pyrazole,imidazole,oxazole.  |
| Chemistry of heterocyclic compounds,synthesis&reactivity of the following systems:isoxazole,pyridazine,pyrimidine&pyrazine   |
| Chemistry of some typical natural products(alkaloids and terpenoids) isolation, structural elucidation, synthesis and biogenesis of alkaloids: atropine, nicotine, quinine.  |
| isolation, structural elucidation, synthesis and biogenesis of terpenoids: alpha – terpineol, alpha piene and camphor.   |

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Syllabus for the Academic Year 2017-18

Department :P.G.ANALYTICAL CHEMISTRY

Paper :ORGANIC CHEMISTRY-II

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:II

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| Aliphatic & aromatic nucleophilic substitution: stereochemistry of SN2 & SN1 mechanisms, neighbouring group participation, NGP by O, S, N  |
| aromatic nucleophilic substitution: SN2 (Ar) (addition-elimination), SN1 (Ar) and benzyne mechanisms (elimination-addition), evidence for the structure of benzyne.  |
| Von Richter, Sommelet-Hauser, Smiles rearrangement. Elimination reaction: type of elimination reactions, mechanisms, stereochemistry and orientations.   |
| Hofmann and Saytzeff rules. Syn eliminations vs anti elimination, competition between elimination and substitutions, dehydration, dehydrogenation, dehalogenation, decarboxylative elimination and pyrolytic eliminations. |
| Addition reactions: a) addition to C-C multiple bonds: mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radical, region and chemo selectivity.                  |
| Orientation and reactivity, hydrogenation of double and triple bonds, hydrogenation of aromatic rings, hydroboration.  |
| Addition to Carbon-hetero multiple bonds: steric course of addition reactions to C=O and C=N, aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt.   |
| Claisen, Dieckmann, Benzoin and Stobbe condensation, Reformatsky reaction, Tolens, Prins reactions; Wittig, Grignard, Mannich and Michael reaction, hydrolysis of carbon nitrogen bond isocyanates and isothiocyanates.    |
| Molecular rearrangements: types of molecular rearrangement, migratory aptitude. Rearrangement to electron deficient carbon: pinacol-pinacolone, Wagner-Meerwein, Tiffeneau-Demjanov.                                       |
| Dienone-phenol, Arndt-Eistert synthesis. Rearrangement to electron deficient nitrogen: Beckmann, Hofmann, Curtius rearrangement.   |
| Schmidt and Lossen rearrangement. Rearrangements to electron deficient oxygen: Baeyer-Villiger, hydroperoxide rearrangement and Dakin rearrangement.   |
| Neber rearrangement, Benzil-benzilic acid and Favorskii rearrangement. Spectroscopy and protecting groups: basic principle and importance of UV.   |
| Basic principle and importance of IR.  |
| Basic principle and importance of NMR.   |
| Basic principle and importance of Mass.  |
| Protection of carbonyl, hydroxyl, carboxylic and amine groups.   |

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Syllabus for the Academic Year 2017-18

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Thermodynamics:concepts of partial molar properties, graphical methods, intercept method and apparent molar volume method.   |
| Chemical potential with T&P Gibbs Duhem equation phase rule from the concept of chemical potential, thermodynamic properties of ideal solutions.   |
| Raoult's law, Henry's law, non ideal systems, concept of fugacity, non ideal solutions, activities and activity coefficients.  |
| Determination activity coefficient from vapour pressure measurement, chemical equilibrium, effect temp on equilibrium constant, Vant hoff equation.                                      |
| Micelles and macro molecules: classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration.  |
| Factors affecting CMC, thermodynamics of micellization , phase separation and mass action models, solubilization, micro emulsions, reverse micelles.                                     |
| Polymers, types of polymers, electrically conducting polymer, liquid crystal polymers, kinetics of free radical polymerization, molecular mass number and mass average molecular weight. |
| Weight determination - end group analysis, osmometry, viscometry, light scattering methods.  |
| Chemical kinetics, collision theory, transition state theory Debye Huckel theory, salt effects.  |
| Hammett equation, Taft equation, consecutive reactions, parallel reactions, opposing reactions.  |
| Acid -base catalysis, Arrhenius diagram, fast reactions flow methods.  |
| Photochemistry: Franck Condon principle, excited molecules, singlet and triplet states.  |
| Spin orbit interactions, actinometry, ferrioxalate and uranyl oxalate actinometers - problems..  |
| Derivation of fluorescence and phosphorescence, quantum yields, quenching effect, Stern Volmer equation.   |

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Syllabus for the Academic Year 2017-18

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-II

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:II

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|---|
| NMR-Principle and Theory Introduction.  |
| Nature of spinning particle and its interaction with magnetic field.Chemical shift&origin spin-spin interaction,Application of NMR to structural elucidation.               |
| Electron spin resonance-principle and experimental technique –g-factor,Line shapes&Line widths hyperfine interactions.  |
| Applications of ESR studies.  |
| Brief review on Entropy changes accompanying specific process-expansion,phase transition,heating measurement of Entropy.  |
| Nernst heat theorem,Third law of thermodynamics-Determination of the absolute entropy.  |
| Types of ensembles,thermodynamic probability,most probable distribution law –partition function,molar&molecular partitions.   |
| Rotational,translational,vibrational&electronic partition function –relation between thermodynamic function (E,H,S,G&C <sub>v</sub> )and the partition functions.           |
| Electrochemistry-Electrochemical cell –Galvanic&Electrolytical cell.Concentration cell with&without transference,effect of complexation on redox potential.                 |
| Ferricyanide\ferrocyanide couple,Iron(III)  |
| phenanthroline/Iron(II) phenanthroline couple.  |
| Determination of standard potential,solubility product equilibrium constant&activity coefficients from EMF data.  |
| Bjerrum theory of ion association concept of activity and activity coefficients in electrolytic solutions.  |
| The mean ionic activity coefficient,Debye-Huckel theory of electrolytic solutions,Limiting law.   |
| Calculation of mean ionic activity coefficient,limitations of Debye-Huckel theory.  |
| Effect of dilution on equivalent conductance of electrolytes,anomalous behavior of strong electrolyte.Debye-Huckel Onsagar equation-verification and limitations,fuel cell. |
| Electrochemistry-II the electrode-electrolyte interface.  |
| The electric double layer.The Helmholtz-Perrin parallel-plate model,The Gouy-chapman diffuse-charge model&the stern model.  |



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Syllabus for the Academic Year 2017-18

Department :P.G.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-I

Class: II M.Sc ANALYTICAL CHEMISTRY

Semester:III

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| Classification different chromatographic methods, theory of chromatography, development techniques elution, gradient elution, displacement and frontal analysis |
| Chromatography phenomena migration, adsorption, partition adsorption coefficient retardation factor, retention time and volume.                                 |
| Partition isotherms, zone spreading, column capacity, temp effects, efficiency of chromatography column.  |
| HETP, Vandemeter equation resolution choice of column length, flow velocity, qualitative and quantitative analysis.   |
| Principle of column chromatography adsorption isotherms chromatographic media nature of forces between sample and stationary phase.                             |
| Column chromatography without detectors and liquid chromatography with detectors and application.   |
| Principles of gel exclusion chromatography properties of xerogels apparatus and detectors resolution.   |
| Principles of capillary electrophoresis, instrumentation applications to inorganic and organic compounds.   |
| Gas chromatography principle Instrumentation, columns detectors thermal conductivity, flame ionization electron capture, N-P detector.                          |
| Photo ionization, temp programming of G.C and applications structure of zeolites crystals types of sieved.  |
| Application in the separation of gases including hydrocarbons ion exclusion principles and applications.  |
| Affinity chromatography principle and applications, GC-MS Principle and instrumentation and applications of GC-MS   |
| Liquid-liquid partition chromatography principle, supports partition liquids, eluents, reverse phase chromatography apparatus applications, HPLC theory.        |
| HPL instrumentation, columns UV detector, RF detector, Fluorescence, diode array detector, .applications in the separation of organic compounds.                |
| Applications in the separation of organic compounds, names of other detectors used their principles and applications. LC-MS principle and instrumentation       |
| LC-MS date ion Chromatograms, selected ion monitoring.  |
| Processing LC-MS data, ion chromatograms, library searching quantitative measurements.  |
| Applications of LC-MS for Drug analysis, Environmental Samples and others.  |

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 Syllabus for the Academic Year 2017-18

Department :P..G.ANALYTICAL CHEMISTRY  
 Class:II MSC ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-II  
 Semester:IV

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| Paper chromatography principle, chromatographic medium, modified papers, solvent, systems mechanism of paper chromatography, experimental technique different development methods.   |
| Desending, horizontal circular spreading multiple development, two dimensional development, reverse phase chromatographic technique visualization chromatograms.   |
| Thin layer chromatography principle, media coating materials, applications simple development, solvent systems development of chromatoplate types of development of chromatoplate types of development visualization methods documentation applications in the separation HPTLC principle, technique applications. |
| Ion exchange chromatography principles systematic ion exchange resins properties of anion and cation exchange resin, ion exchange mechanism equilibria, selectivity, ion exchange capacity, applications of ion exchangers.  |
| In different fields, principles of ion exchange systems, equipment application specifically separations of lanthanides, actinides, amino acids , Ion chromatography principles of separation instrumentation, detectors.   |
| Separation of cations and anions applications in the analysis of water and air pollutants,. Basis of sampling, purpose of sampling homogenous and heterogeneous samples.   |
| Statistical criteria for good sampling sample size sampling unit, gross sample, Laboratory sample, sampling of solids, cone and quartering method.   |
| Long pile and alternative shovel method, precautions in preservation of solid samples.   |
| sampling of metals and other solids rods wires, sheets, plates especially gold, silver, iron and other metals..  |
| Sampling of different types of liquids and techniques, sampling of drinking water industrial effluents. Precautions in sampling and preservation of collected liquids.   |
| Sampling of gases and preconcentration by adsorption or absorption method instantaneous monitoring, precautions.   |
| In preservation of samples, systematic sampling and random sampling importance of analytical chemistry   |
| To industrial research and development industries and other branches of science, development and validation of an analytical method.   |
| Units concentrations calculations, standards, chemical reactions, importance of separation methods with examples. principles and processes of solvent extraction, distribution law and partition coefficient, nature of partition forces.  |
| Different types of solvent extraction , solvent extraction systems, applications in metallurgy, general application in analysis and pre- concentration.  |
| Special extraction systems like crown ethers, super fluid and surfactant extractions- examples.  |

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Syllabus for the Academic Year 2017-18

Department:P.G. ANALYTICAL CHEMISTRY

Paper:QC&Traditional Methods of Analysis-I

Class:II M.Sc.Analytical chemistry

Semester:III

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|---|
| Classification of functional groups with suitable examples,Determination of functional groups imparting acidic nature-Thiol,Endiol.   |
| Determination of imparting acidic nature-Phenolic hydroxyl.Determination of imparting basic nature Aliphatic&Aromatic amines.Difference b/w Aliphatic and Aromatic Amines.                |
| Determination of Primary,Secondary,Tertiary Amines&Hydride derivatives.   |
| Functional groups which imparting neither acidic nor basic nature-Aldehydes,Ketones,Nitro group,Methoxy,Aliphatic group.  |
| Characteristics of an analysis-LOD,Sensitivity,Safety,Cost measurability,Selectivity&Specificity.   |
| Classification of errors,minimization of errors,ISO 9000 series,ISO 14000 series.   |
| Good laboratory practices&ICH guide lines on drug substances&products,control charts.   |
| Accuracy,precision,significant figures,normal distribution,F-test   |
| Oxidant systems-Principles &Applications in Analysis-Inorganic systems Mn(III),Mn(VII),Ce(IV),Cr(VI)is determined.  |
| Determination of Inorganic systems V(v),Periodate,Iodate.Organic systems Chloramine-T.Oxidant properties and indicators.  |
| Organic compounds Principles of solubility of organic compounds,Non polar,Polar solvents.Recrystallisation method and applications of solubility and recrystallisation.                   |
| Inorganic compounds definition of dissolution &decomposition.Principles of decomposition &dissolution,difference b/w Dissolution&decomposition. Decomposition with H <sub>2</sub> O,HCl . |
| Decomposition with HF,HNO <sub>3</sub> ,H <sub>2</sub> SO <sub>4</sub> &HClO <sub>4</sub>   |
| Definition of fusion &Sintering.Difference b/w fusion & sintering &fusion with sintering with decomposition with examples.  |
| Decomposition techniques and parameters needs to be consider in the decomposing the samples for Analysis.   |
| Absorption of microwave energy and heating .Explain the ultrasonic assisted extraction.   |
| Statistical analysis –Mean deviation,standard deviation,coefficient of variance,T-test,Ruggedness test,Youden plot,Ranking test.  |
| Computations and propagation of errors representation of data,production and service elements of quality assurance,quality and quantity management system ,control tools.                 |

**DANTULURI NARAYANA RAJU COLLEGE(AUTONOMOUS)**

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Bhimavaram, W.G.Dist, A.P

Syllabus for the Academic Year 2017-18

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Traditional Methods of Analysis-II

Class:II M.Sc.Analytical chemistry

Semester:IV

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| Precipitation methods-I:crystal habit &super saturation,nucleation and crystal growth,homogeneous&heterogeneous nucleation,solubility and particle size,colloids,completeness of precipitation                    |
| Effect of excess precipitant,ph,complex formation,temperature,purity of precipitates,aging.Co-precipitation & post precipitation:theory of adsorption of salts having an ion in common with the main precipitate. |
| Co-precipitation in colloidal precipitates,adsorption of solvents,mixed crystal formation by occlusion and entrapment,re-precipitation with examples,post-precipitation-theory of post-precipitation              |
| Examples of post precipitation,conditions for obtaining pure and quantitative precipitates.Precipitation titrations:principle,indicators for precipitation titrations,determination of halides.                   |
| Precipitation from homogeneous solution(PFHS):theory of PFHS,methods of PFHS-increase in pH,decrease in pH,cation release,anion release,reagent synthesis.  |
| Change in oxidation state,photochemical reactions,precipitation from mixed solvents,applications of PFHS methods.Gravimetric determinations:nature of species,preparation of solutions,limitations.               |
| Interferences,inorganic precipitants-chloride and sulphates,organic precipitants dimethyl glyoxime ,oxime,benzidine,salicyladoxime,benzoin oxime,sodium tetraphenyl boron,tetraphenyl arsonium chloride.          |
| Electro-gravimetric analysis:principle,important terms in electrogravimetry,decomposition voltage or decomposition potential,over voltage and their importance,instrumentation,electrolysis at constant current.  |
| Determination of Cu(II) by constant current electrolysis,electrolysis at controlled potentials,determination of Cu,Pb,Sn in brass and bronze by controlled potential electrolysis.                                |
| Reductant system-principles and applications in analysis:analytical chemistry of some selected reductant systems-formal.  |
| Standard and normal potential in various media,stability of the solutions,species responsible for the reduction properties.   |
| Standardisation,requirement for the selection of the reductants,selection of suitable indicators for various reductants systems.  |
| Inorganic systems-Cr(II),V(II),Ti(III),Sn(II),Fe(II) in H <sub>3</sub> PO <sub>4</sub> and hydrazine.   |
| Organic systems-hydroquinone and ascorbic acid,Analysis of some selected drugs:basic considerations of drugs-classification.  |
| Determination of the following drugs:acetyl salicylic acid,testosterone progesterone,cortisone  |
| Determination of sulphadiazine,phenobarbitone   |
| Determination of chloramphenicol,benzyl penicillin and tetracycline,thiamine,riboflavin,ascorbic acid.  |

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Syllabus for the Academic Year 2017-18

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Intorduction of applied analysis, dissolution of complex materials various de chemical methods. Introduction of iron ore.  |
| Determiration of iron ore, determination manganese ore.  |
| Analysis of chromite ore and analysis of phosphate rock ore.   |
| Analysis of aluminium ore , analysis of finished product-1, analysis of steel.   |
| Analysis of blast furnance slag, analysis of refractory materials.   |
| Analysis of fluxes, analysis finished product-2, analysis of cement.   |
| Analysis of oils and analysis of soaps.  |
| Analysis of paints, introduction of water quality, standards for drinking water.   |
| Source of water, classification of water for different uses.   |
| Types of water pollutants and their affects, analytical methods, the determiration of anions like $\text{CO}_3^{-2}$ , $\text{HCO}_3^-$ , $\text{Cl}^-$ , $\text{F}^-$ |
| Analysis of anions $\text{SO}_4^{-2}$ , $\text{PO}_4^{-3}$ , $\text{NO}_3^-$ , $\text{NO}_2^-$ ,   |
| Determiration of anions is cynide, sulphide, determiration of cations like $\text{Fe}^{+2}$ , $\text{Fe}^{+3}$ $\text{Ca}^{+2}$ , $\text{Mg}^{+2}$ .                   |
| Determiration of cations $\text{Cr}^{+3}$ , $\text{As}^{+5}$ .   |
| Determiration of cations $\text{Pb}^{+2}$ , $\text{Hg}^{+2}$ , $\text{Cu}^{+2}$ .  |
| Determiration of cations $\text{Zn}^{+2}$ , $\text{Cd}^{+2}$ , $\text{Co}^{+2}$ .  |
| Determiration of D.O,B.O.D,C.O.D.  |
| Standards for drinking water, general introduction, uses and application of water quality.   |
| Saponification number,iodine number,acid number,diffirent uses for the assessment of water quality   |

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Syllabus for the Academic Year 2017-18

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Introduction of analysis of raw materials,analysis of non-ferrous alloys,analysis of ferro alloys   |
| Analysis of brass,analysis of bronze,analysis of solder   |
| Analysis of ferro silicon constituents are si,c,p,s;analysis of ferro vanadium constituents are v,c,p,s,si,Al   |
| Analysis of ferro manganese,analysis of silico manganese  |
| Introduction of analysis of soils,fertilizers and fuel  |
| Analysis of soils:sampling,determination of moisture,total N,P,Si,lime,humus nitrogen,alkali salts,soil absorption ratio.   |
| Analysis of fertilizer:ammonical fertilizers,phosphate fertilizes,nitrate fertilizers   |
| Analysis of fuels:sold fuels-coal,proximate analysis,ultimate analysis,heating value,grading of coil based on ultimate heat value{UHV}  |
| Assessment oair quality:composition opure air,classification of air pollutants,toxic elements presents in dust and their sources  |
| Collection of air samples,sources,effects,control of pollution and chemical analysis for the following  |
| Primary pollutants:corbon compounds-(CO),carbon dioxide,sulphur compounds:sulphur dioxide,sulphur trioxide,hydrogen sulphide  |
| Nitrogen compounds:nitric oxide,nitrogen dioxide,hydrocarbons:-aliphatic hydrocarbons&polycyclic aromatic hydrocarbons  |
| Particulate matter-repairable&suspended particulate matter,inorganic&organic particulates   |
| Secondary pollutants-ozone,peroxy acetyl nitrate,peroxy benzyl nitrate;standards for amient air quality   |
| Kinetic methods of analysis:introduction,slow reactions,catalyzed reactions   |
| Methods of determination of catalyst concentration,extrapolation methods for the determination of catalyst,variable time method,fixed time method   |
| Examples for the determination of toxic metals and anions using some typical kinetic reactions.Non aqueous titrimetry:classification of solvents and titrations for non aqueous titrymetry. |
| Types of reactions-indicators:determination of acids,determination of bases,karl-fisher reagent for the determination of moisture content in drugs and other samples                        |

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Syllabus for the Academic Year 2017-18

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-I

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:III

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| Laws of absorption, deviations from beer's law, single and double beam, spectrometers.   |
| Instrumentation, sources of radiation detectors qualitative analysis by absorption measurements , general precautions in colorimetric determination,.  |
| Spectro photometric titrations, principle of diode array detector determination of $Fe^{+2}$ , and $Fe^{+3}$ .   |
| Determination of $Al^{+3}$ , $NH_4^+$ , $Cr^{+3}$ , $Cr^{+6}$ , $Co^{+3}$ , $Cu^{+2}$ , $Ni^{+2}$ , $NO_2^-$ , $PO_4^{-3}$ , Simultaneous determination of $KMnO_4$ and $K_2Cr_2O_7$ . Theory of fluorescence and phosphorescence, factors affecting these two, principle and instrumentation of Spectrofluorimetry. |
| Units of frequency, wavelength, and wave number, molecular vibrations factors influencing frequencies, instrumentation of IR spectroscopy.   |
| Sampling techniques detectors in IR, qualitative and quantitative analysis with reference to selected molecules like CO and $CO_2$ .   |
| Non destructive IR method for the analysis of CO and other organic compounds, principle of FT-IR.  |
| Theory of Raman spectroscopy and instrumentation and Raman spectra of CO, $CO_2$ , $N_2O$ and $H_2O$ , Differences between Raman spectra and IR spectra.   |
| Resonance condition, Origin of NMR spectra, factors affecting chemical shift, shielding and de shielding.  |
| Spin-spin coupling, interpretation of NMR spectra of organic compounds factors influencing NMR spectra Fast chemical reactions   |
| Magnitude of I, nuclei with Quadrapole moments FT-NMR Study of isotopes other than proton $^{13}C$ $^{15}N$ , $^{19}F$ , $^{31}P$ , $^{11}B$ double resonance, shift reagents, Spin tickling and applications.   |
| Theory of ESR and instrumentation , g-value, hyperfine splitting qualitative analysis, Kramer's degeneracy.  |
| Instrumentation of ESR differences between ESR and NMR spectra. Qualitative analysis, study of free radicals and other applications.   |
| Mass spectroscopy principle and ion sources, inlets, detectors.  |
| Types of peaks, observed resolution qualitative analysis molecular weight determination  |
| X-RF wavelength, dispersive technique and evaluation methods.  |
| X-RF energy dispersive technique and evaluation method, applications. Qualitative analysis of X-RF.  |
| Instrumentation of X-RF, matrix effects, and its advantages.   |

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Syllabus for the Academic Year 2017-18

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-II

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:IV

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| Flame photometry theory, instrumentation combustion flames, detectors, and analysis of Na, K ,Ca and Mg, atomic absorption spectrometer theory and instrumentation, flame techniques.  |
| Resonance line sources, hollow cathode lamp chemical and spectral interferences. applications with special reference to analysis of trace metal in oils, allows and toxic metals in drinking water and effluents.  |
| ICP-AES, ICP-MS principles, instrumentation of plasma, AES detectors, quadra-pole mass spectrometers, differences between the two detectors.   |
| Applications of liquids and solids, applications in the analysis of trace and toxic metals in water geological and industrial samples, arc and spark spectrographic direct analysis of solid for metals.   |
| Thermo Gravimetry theory, instrumentation and applications, with special reference to $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , $\text{CaCO}_3$ , $(\text{COOH})_2$ . differential thermal analysis- principle, instrumentation, difference between TG and DTA. |
| DTA-applications with special reference to the clays and minerals coals (fuels), differential scanning calorimetry - principle, instrumentation and applications to inorganic materials like chlorates and per chlorates   |
| Determination of ammonium nitrate organic compound and drugs by using DSC. Principle of Polarography, , residual current, migration current ,diffusion current, half wave potential ILKOVIC equation and DME instrumentation.  |
| Advantages & disadvantages, qualitative and quantitative analysis of inorganic ions Cu, Bi , Pb,Cd and Zn. AC polarography, pulse polarography   |
| Principle, instrumentation of HMDE application in the analysis of Pb and Cd in environmental samples.  |
| Principle of cathode stripping voltametry principles of coulometric analysis with constant current coulometric analysis of cations- As(III),Fe(II).  |
| Determination $\text{I}^-$ and $\text{S}^{2-}$ by using $\text{I}_2$ liberations and $\text{Ce}^{+4}$ liberation in solutions coulometric analysis with controlled potentials.   |
| Reference electrodes- hydrogen electrode calomel electrode, silver chloride.   |
| Indicator electrodes- hydrogen electrode, glass electrodes, theory of membrane potentials and glass electrodes, theory of membrane potentials and liquid junction potentials, calibration of ion selective electrodes.   |
| Ion selective electrodes with fixed membrane sited Ag, Pb, Cd, S, F, CN and glass electrodes applications in the analysis of air and water.  |
| Detection and measurements of radio activity introduction to radioactive traces applications of tracer technique.  |
| Isotope dilution analysis applications activation analysis applications advantages disadvantages radio carbon dating technique.  |



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Syllabus for the Academic Year 2016-17

Department:P.G.ANALYTICAL CHEMISTRY

Paper: GENERAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Wave equation-interpretation of wave function-properties of wave function-Normalisation and orthogonalisation  |
| Operators-Linear and Non linear ,Commutators of Operators  |
| Postulates of Quantum mechanics,Setting up of operators obserbables  |
| Hermitian operator-Eigen values of hermitian operator  |
| Basic quantum chemistry-II; Wave mechanics of simple systems with constant potential energy ,partical in one dimensional box .   |
| Factors influencing color transition –dipole integral , symmetry arguments in deriving the selection rules.  |
| Wave mechanics of systems with variable potential energy –symple harmonic oscillator , solution of wave equation-selection rules.  |
| calculation of bond length –isotopic effect,second order stark effect and its applications   |
| Molecular spectroscopy-I;Rotational spectra of diatomic molecules-Rigid rotor Selection rules-calculation of bond length –isotopic effect,second order stark effect and its applications |
| Infrared spectra of diatomic molecules , harmonic and anharmonic oscillators –selection rules.   |
| Overtone combination bands – calculation of force constant , anharmonicity constant and zero point energy.   |
| Fermi resonance ,simultaneous vibration-rotation spectra of diatomic molecule .  |
| Molecular spectroscopyII-Raman effect –classical and quantum mechanical explanations   |
| Franck Condon principle –applications ,Rotational fine structure . Charge transfer spectra-band head and band shading  |

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Syllabus for the Academic Year 2016-17

Department : P.G.ANALYTICAL CHEMISTRY

Paper :GENERAL CHEMISTRY

Class: I M.SC ANALYTICAL CHEMISTRY

Semester:II

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|---|
| Basic Quantum chemistry III-Hydrogen atom ,probability density in orbitals ,shapes of orbitals .  |
| Perturbation theory- line independent perturbation theory Only first order perturbation is to be dealt with   |
| Application to ground state energy of Helium atom . Variation principle –Application – Calculation  |
| Molecular symmetry and group theory in chemistry, basic concepts of symmetry and group theory-symmetry elements.                                      |
| Symmetry operations and point groups, classification of molecules in to point groups.   |
| Group theory – group multiplication table for C <sub>2v</sub> and C <sub>3v</sub> point groups.   |
| Representations, reducible and irreducible representations, Mulliken symbols, orthogonality theorem and its implications                              |
| Treatment of analytical data, classification of errors, determinations of indeterminate errors, minimisation of errors- absolute and relative errors, |
| Standard deviations- standard error of mean – student' t-test, testing for significance – comparison of two means – f –tes.                           |
| Introduction to computer programming – basic structure and functioning of computer with pc as an illustrative examples.                               |
| Main memory – secondary storage memory – in put, out put devices  |
| Computer languages operating systems – principles of algorithms and flow charts.  |
| Arithmetic expressions – arithmetic statements- replacement statements – IF statements.   |
| Logical IF and block IF statements – GOTO statements, subscripted, variable and DIMENSION statement   |
| DO statement – rules for DO statements, functions and subroutines-development of FORTRAN statements for simple formula in chemistry.                  |
| Nernst equation, pH of solution – first order rate equation – cell constant – electrode potential.  |

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Syllabus for the Academic Year 2016-17

**Department:P.G. ANALYTICAL CHEMISTRY**

**Paper: Inorganic chemistry-I**

**Class: I MSc.ANALYTICAL CHEMISTRY**

**Semester:I**

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| Structure & Bonding:Application of VSEPR ,Valence bond theory and applications.   |
| Molecular orbital theories,Structure of Simple molecules.   |
| Applications of MO theory to Square planar &Octahedral complexes.   |
| Walsh diagram for water molecule.   |
| Coordination compounds;Crystal field theory- Crystal field splitting patterns in octahedral,tetrahedral,tetragonal ,square planar,trigonal bipyramidal geometries.                  |
| Calculations of CFSE, Factors affecting crystal field splitting energies ,spectrochemical series .  |
| Jahn-Teller effect, Nephelauxetic effect, ligand field theory .   |
| Term symbols –Russell sanders coupling, derivation of term symbols for various configurations .Spectroscopic ground states.   |
| Inorganic cage and ring compounds; Preparation ,structure and reactions of boranes , carboranes.  |
| Preparation , structure and reactions of metallocarboranes ,boron-nitrogen cyclic compounds .   |
| Phosphorus-nitrogen and sulphur- nitrogen cyclic compounds .  |
| Electron counting in boranes –Wades rules.Isopoly and Heteropoly acids.   |
| Electronic spectra of transition metal complexes;Selection rules ,break down of selection rules Orgel diagrams,T-S diagrams for $d^1$ - $d^9$ Octahedral and tetrahedral complexes. |
| Charge transfer spectra , Quenching of orbital momentum .   |

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Syllabus for the Academic Year 2016-17

**Department:P.G. ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-II**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:II**

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| Metal cluster compounds –Definition –evidences for existence of M-M bonds conditions favourable for formation of M-M bonds   |
| Classification of binuclear cluster compounds ,Confacial bioctahedron structures   |
| Trinuclear cluster compounds and polynuclear cluster compounds   |
| Polyatomic clusters –Zintl ions,chevreton phases.  |
| Organo metallic compounds :16 and18 electrons rules, isolobal relation ship  |
| Iso electron relationship- synthesis structure and bonding of carbonmonoxide dinitrogen and nitricoxide complexes.   |
| Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.   |
| Classification metal carbonyls.  |
| Metal ligand equilibrium in solution: step wise and overall formation constants, factors effecting the stability metal complexes.                                    |
| Pearsons theory of hard and soft acids and basis, chelate effect, determination of stability constant.   |
| Inert and labile complexes, explanation of lability on the basis of VBT and CFT.biological and abiological nitrogen fixation.  |
| Metalo porphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to $Ca^{+2}$ . |
| In organic reaction mechanisms:ligand replacement reactions of metal complexes, acid hydrolysis- factors effecting acid hydrolysis.                                  |
| Anation and base hydrolysis of cobalt (III)complexes, ligand displacement reactions of square planar complexes of Pt(II).  |
| Factors effecting square planar substitutions – trans effect, complementary and non complementary reactions with examples.   |
| Electron transfer reactions of complexes- inner and outer sphere mechanisms.   |

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Syllabus for the Academic Year 2016-17

Department :P.G.ANALYTICAL CHEMISTRY

Paper :ORGANIC CHEMISTRY-I

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:I

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| Nature of bonding in organic molecules and aromaticity:a)electronic effects and reactive intermediates: inductive effect, mesomeric effect, hyper conjugation, steric effect, tautomerism..  |
| Acidity and basicity of organic molecules, generation, structure, stability and reactivity of carbocations, carbanions, carbon free radicals, nitrenes and arynes.   |
| Criteria of aromaticity: the energy, structure and electronic, criteria, for aromaticity relationship among the energetic, structural and electronic criteria of aromaticity.  |
| Huckles rule and MO theory, aromaticity in benzenoid and nonbenzenoid compounds, aromaticity in charged and fused ring systems, hetero aromatic systems.   |
| Annulenes :cyclo butadiene, benzene, 1,3,5,7-cyclo tetraene, [10],[12],[14],[16] and[18] annulenes, azulenes fulvenes, fullerenes, ferrocene, anti aromaticity and homo aromaticity.   |
| Stereo chemistry and molecular representation of organic molecules:a)molecular symmetry and chirality:symmetry elements, definition and classifications of stereo isomers, enantiomers, diastereomers,invertomers,homomers,epimers, anomer, configuration and conformation configurational nomenclature.   |
| D,L and R,S nomenclature, molecules with a single chiral centre: tetra and tri coordinate chiral centre,molecules with two or more chiral centres, constitutionally unsymmetrical molecules.b)geometrical isomerism and conformations of cyclic systems:cis-trans, E,Z-and syn & anti nomenclature.  |
| Methods of determining configuration of geometrical isomers using, physical, spectral and chemical methods, stability, cis-trans inter conversion. Conformations of cyclo butane, cyclo pentane, cyclo hexane, mono and disubstituted cyclo hexanes  |
| Prochirality&prostereomerism:homotopic ligands faces&faces,enantiotopic ligands&faces,diastereotopic ligands&faces.d)stereoisomerism in molecules without chiral center-axial chirality allenes,alkylidene cycloalkanes,spiranes,atropisomerism:biphenyl derivatives,nomenclature. planar chirality:ansa compounds,paracyclophanes,trans-cyclooctene&helicity. |
| Heterocyclic compounds:importance of heterocyclic compounds as drugs,nomenclature of heterocyclic systems based on ring size,number&nature of heteroatoms.   |
| Chemistry of heterocyclic compounds,synthesis&reactivity of the following systems:quinoline,isoquinoline,indole,pyrazole,imidazole,oxazole.  |
| Chemistry of heterocyclic compounds,synthesis&reactivity of the following systems:isoxazole,pyridazine,pyrimidine&pyrazine   |
| Chemistry of some typical natural products(alkaloids and terpenoids) isolation, structural elucidation, synthesis and biogenesis of alkaloids: atropine, nicotine, quinine.  |
| isolation, structural elucidation, synthesis and biogenesis of terpenoids: alpha – terpineol, alpha pinenene and camphor.  |

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Syllabus for the Academic Year 2016-17

Department :P.G.ANALYTICAL CHEMISTRY

Paper :ORGANIC CHEMISTRY-I I

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:II

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| Aliphatic & aromatic nucleophilic substitution: stereochemistry of SN2&SN1 mechanisms, neighbouring group participation, NGP by O,S,N  |
| aromatic nucleophilic substitution: SN2 (Ar)(addition-elimination), SN1(Ar) and benzyne mechanisms(elimination-addition), evidence for the structure of benzyne.   |
| Von Richter, Sommelet – Hauser, Smiles rearrangement. Elimination reaction: type of elimination reactions, mechanisms, stereochemistry and orientations.   |
| Hofmann and Saytzeff rules. Syn eliminations vs anti elimination, competition between elimination and substitutions, dehydration, dehydrogenation, dehalogenation, decarboxylative elimination and pyrolytic eliminations. |
| Addition reactions :a) addition to C-C multiple bonds: mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radical, region and chemo selectivity.                  |
| Orientation and reactivity, hydrogenation of double and triple bonds, hydrogenation of aromatic rings, hydroboration.  |
| Addition to Carbon-hetero multiple bonds: steric course of addition reactions to C=O and C=N, aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt.   |
| Claisen, Dieckmann, Benzoin and Stobbe condensation, Reformatsky reaction, Tollen's, Prins reactions; Wittig, Grignard, Mannich and Michael reaction, hydrolysis of carbon nitrogen bond isocyanates and isothiocyanates.  |
| Molecular rearrangements: types of molecular rearrangement, migratory aptitude. Rearrangement to electron deficient carbon: pinacol-pinacolone, Wagner – Meerwein, Tiffeneau – Demjanov.                                   |
| Dienone-phenol, Arndt-Eistert synthesis. Rearrangement to electron deficient nitrogen: Beckmann, Hofmann, Curtius rearrangement.   |
| Schmidt and Lossen rearrangement. Rearrangements to electron deficient oxygen: Baeyer – Villiger, hydroperoxide rearrangement and Dakin rearrangement.   |
| Neber rearrangement, Benzil-benzilic acid and Favorskii rearrangement. Spectroscopy and protecting groups: basic principle and importance of UV.   |
| Basic principle and importance of IR.  |
| Basic principle and importance of NMR.   |
| Basic principle and importance of Mass.  |
| Protection of carbonyl, hydroxyl, carboxylic and amine groups.   |

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Syllabus for the Academic Year 2016-17

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Thermodynamics:concepts of partial molar properties, graphical methods, intercept method and apparent molar volume method.   |
| Chemical potential with T&P Gibbs Duhem equation phase rule from the concept of chemical potential, thermodynamic properties of ideal solutions.   |
| Raoult's law, Henry's law, non ideal systems, concept of fugacity, non ideal solutions, activities and activity coefficients.  |
| Determination activity coefficient from vapour pressure measurement, chemical equilibrium, effect temp on equilibrium constant, Van't Hoff equation.                                     |
| Micelles and macro molecules: classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration.  |
| Factors affecting CMC, thermodynamics of micellization, phase separation and mass action models, solubilization, micro emulsions, reverse micelles.                                      |
| Polymers, types of polymers, electrically conducting polymer, liquid crystal polymers, kinetics of free radical polymerization, molecular mass number and mass average molecular weight. |
| Weight determination - end group analysis, osmometry, viscometry, light scattering methods.  |
| Chemical kinetics, collision theory, transition state theory Debye-Huckel theory, salt effects.  |
| Hammett equation, Taft equation, consecutive reactions, parallel reactions, opposing reactions.  |
| Acid-base catalysis, Arrhenius diagram, fast reactions flow methods.   |
| Photochemistry: Franck-Condon principle, excited molecules, singlet and triplet states, spin orbit interactions, actinometry, ferrioxalate and uranyl oxalate actinometers – problems.   |
| photochemical primary process, types of photochemical reactions, photodissociation, additional isomerisation reactions with examples.  |
| primary process, types of photochemical reactions, photodissociation, additional isomerisation reactions with examples.  |

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Syllabus for the Academic Year 2016-17

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-II

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:II

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| NMR-Principle and Theory Introduction.  |
| Nature of spinning particle and its interaction with magnetic field.Chemical shift&origin spin-spin interaction,Application of NMR to structural elucidation.               |
| Electron spin resonance-principle and experimental technique –g-factor,Line shapes&Line widths hyperfine interactions.  |
| Applications of ESR studies.dimethylformamide,styrene   |
| Brief review on Entropy changes accompanying specific process-expansion,phase transition,heating measurement of Entropy.  |
| Nernst heat theorem,Third law of thermodynamics-Determination of the absolute entropy.  |
| Types of ensembles,thermodynamic probability,most probable distribution law –partition function,molar&molecular partitions.   |
| Rotational,translational,vibrational&electronic partition function –relation between thermodynamic function (E,H,S,G&Cv)and the partition.                                  |
| Electrochemistry-Electrochemical cell –Galvanic&Electrolytical cell.Concentration cell with&without transference,effect of complexation on redox potential.                 |
| Ferricyanide\ferrocyanide couple,Iron(III) .free radicals,metal complexes and biological systems. phenanthroline/Iron(II) phenanthroline couple.                            |
| Determination of standard potential,solubility product equilibrium constant&activity coefficients from EMF data.  |
| Bjerrum theory of ion association concept of activity and activity coefficients in electrolytic solutions.  |
| The mean ionic activity coefficient,Debye-Huckel theory of electrolytic solutions,Limiting law.   |
| Calculation of mean ionic activity coefficient,limitations of Debye-Huckel theory.  |
| Effect of dilution on equivalent conductance of electrolytes,anomalous behavior of strong electrolyte.Debye-Huckel Onsagar equation-verification and limitations,fuel cell. |
| Electrochemistry-II the electrode-electrolyte interface.primary and secondary cells,batteries examples.   |
| The electric double layer.The Helmholtz-Perrin parallel-plate model,The Gouy-chapman diffuse-charge model&the stern   |



**DANTULURI NARAYANA RAJU COLLEGE(AUTONOMOUS)**  
 (A College with Potential for Excellence)  
 Bhimavaram, W.G.Dist, A.P  
 Syllabus for the Academic Year 2016-17

Department :P.G.ANALYTICAL CHEMISTRY  
 Class: II MSC ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-I  
 Semester:III

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| Classification different chromatographic methods, theory of chromatography, development techniques elution, gradient elution, displacement and frontal analysis |
| Chromatography phenomena migration, adsorption, partition adsorption coefficient retardation factor, retention time and volume.                                 |
| Partition isotherms, zone spreading, column capacity, temp effects, efficiency of chromatography column.  |
| HETP, Vandemeter equation resolution choice of column length, flow velocity, qualitative and quantitative analysis.   |
| Principle of column chromatography adsorption isotherms chromatographic media nature of forces between sample and stationary phase.                             |
| Column chromatography without detectors and liquid chromatography with detectors and application.   |
| Principles of gel exclusion chromatography properties of xerogels apparatus and detectors resolution.   |
| Principles of capillary electrophoresis, instrumentation applications to inorganic and organic compounds.   |
| Gas chromatography principle Instrumentation, columns detectors thermal conductivity, flame ionization electron capture,N-P detector.                           |
| Photo ionization, temp programming of G.C and applications structure of zeolites crystals types of sieves.  |
| Application in the separation of gases including hydrocarbons ion exclusion principles and applications.  |
| Affinity chromatography principle and applications, GC-MS Principle and instrumentation and applications of GC-MS   |
| Liquid-liquid partition chromatography principle, supports partition liquids, eluents, reverse phase chromatography apparatus applications, HPLC theory.        |
| HPL instrumentation, columns UV detector, RF detector, Fluorescence, diode array detector, .applications in the separation of organic compounds.                |
| Applications in the separation of organic compounds, names of other detectors used their principles and applications.   |
| LC-MS principle and instrumentation LC-MS data ion Chromatograms, selected ion monitoring. Processing LC-MS data, ion chromatograms.                            |

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 Syllabus for the Academic Year 2016-17

Department :P..G.ANALYTICAL CHEMISTRY  
 Class:II MSC ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-II  
 Semester:IV

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| Paper chromatography principle, chromatographic medium, modified papers, solvent, systems mechanism of paper chromatography, experimental technique different development methods.   |
| Desending, horizontal circular spreading multiple development, two dimensional development, reverse phase chromatographic technique visualization chromatograms.   |
| Thin layer chromatography principle, media coating materials, applications simple development, solvent systems development of chromatoplate types of development of chromatoplate types of development visualization methods documentation applications in the separation HPTLC principle, technique applications. |
| Ion exchange chromatography principles systematic ion exchange resins properties of anion and cation exchange resin, ion exchange mechanism equilibria, selectivity, ion exchange capacity, applications of ion exchangers.  |
| In different fields, principles of ion exchange systems, equipment application specifically separations of lanthanides, actinides, amino acids , Ion chromatography principles o f separation instrumentation, detectors.  |
| Separation of cations and anions applications in the analysis of water and air pollutants,. Basis of sampling, purpose of sampling homogenous and heterogeneous samples.   |
| Statistical criteria for good sampling sample size sampling unit, gross sample, Laboratory sample, sampling of solids, cone and quartering method.   |
| Long pile and alternative shovel method, precautions in preservation of solid samples.   |
| sampling of metals and other solids rods wires, sheets, plates especially gold, silver, iron and other metals.   |
| Sampling of different types of liquids and techniques, sampling of drinking water industrial effluents. Precautions in sampling and preservation of collected liquids.   |
| Sampling of gases and preconcentration by adsorption or absorption method instantaneous monitoring, precautions.   |
| In preservation of samples, systematic sampling and random sampling importance of analytical chemistry   |
| To industrial research and development industries and other branches of science, development and validation of an analytical method.   |
| Units concentrations calculations, standards, chemical reactions, importance of separation methods with examples. principles and processes of solvent extraction, distribution law and partition coefficient, nature of partition forces.  |
| Different types of solvent extraction , solvent extraction systems, applications in metallurgy, general application in analysis and pre- concentration.  |
| Special extraction systems like crown ethers, super fluid and surfactant extractions- examples.  |

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Syllabus for the Academic Year 2016-17

Department:P.G.ANALYTICAL CHEMISTRY

Paper:QC&Traditional Methods of Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Classification of functional groups with suitable examples,Determination of functional groups imparting acidic nature-Thiol,Endiol.   |
| Determination of imparting acidic nature-Phenolic hydroxyl.Determination of imparting basic nature Aliphatic&Aromatic amines.Difference b\w Aliphatic and Aromatic Amines.                |
| Determination of Primary,Secondary,Tertialy Amines&Hydrize derivatives.   |
| Functional groups which imparting neither acidic nor basic nature-Aldehydes,Ketones,Nitro group,Methoxy,Olifinic group.   |
| Characterstics of an analysis-LOD,Sensitivity,Safty,Cost measurability,Selectivity&Specificity.   |
| Classification of errors,minimization of errors,ISO 9000 series,ISO 14000 series.   |
| Good labarotary practices&ICH guide lines on drug substances&products,control charts.   |
| Accuracy,precession,significant figures,normal distribustion,F-test   |
| Oxidant systems-Principles &Applications in Analysis-Inorganic systems Mn(III),Mn(VII),Ce(IV),Cr(VI)is determined.  |
| Determination of Inorganic systems V(v),Periodate,Iodate.Organic systems Chloramine-T.Oxidant properties and indicators.  |
| Organic compounds Principles of solubility of organic compounds,Non polar,Polar solvents.Recrystalliisation method and applications of solubility and recrystallisation.                  |
| Inorganic compounds definition of dissolution &decomposition.Principles of decomposition &dissolution,difference b\w Dissolution&decomposition. Decomposition with H <sub>2</sub> O,Hcl . |
| Decomposition with HF,HNO <sub>3</sub> ,H <sub>2</sub> SO <sub>4</sub> &HClO <sub>4</sub>   |
| Defination of fusion &Sintering.Difference b\w fusion & sintering &fusion with sintering with decomposition with examples.  |
| Decomposition techniques and parameters needs to be consider in the decomposing the samples for Analysis.   |
| Absorption of microwave energy and heating .Explain the ultrasonic resistered extraction.   |
| Statistical analysis –Mean deviation,standard deviation,coefficient of variance,T-test,Ruggedness test,Youden plot,Ranking test.  |
| Computations and propagation of errors representation of data,production and service elements of quality assurance,quality and quantity management system ,control tools.                 |

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Syllabus for the Academic Year 2016-17

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Traditional Methods of Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Precipitation methods-I:crystal habit &super saturation,nucleation and crystal growth,homogeneous&heterogeneous nucleation,solubility and particle size,colloids,completeness of precipitation                    |
| Effect of excess precipitant,ph,complex formation,temperature,purity of precipitates,aging.Co-precipitation & post precipitation:theory of adsorption of salts having an ion in common with the main precipitate. |
| Co-precipitation in colloidal precipitates,adsorption of solvents,mixed crystal formation by occlusion and entrapment,re-precipitation with examples,post-precipitation-theory of post-precipitation              |
| Examples of post precipitation,conditions for obtaining pure and quantitative precipitates.Precipitation titrations:principle,indicators for precipitation titrations,determination of halides.                   |
| Precipitation from homogeneous solution(PFHS):theory of PFHS,methods of PFHS-increase in pH,decrease in pH,cation release,anion release,reagent synthesis.  |
| Change in oxidation state,photochemical reactions,precipitation from mixed solvents,applications of PFHS methods.Gravimetric determinations:nature of species,preparation of solutions,limitations.               |
| Interferences,inorganic precipitants-chloride and sulphates,organic precipitants dimethyl glyoxime ,oxime,benzidine,salicyladoxime,benzoin oxime,sodium tetraphenyl boron,tetraphenyl arsonium chloride.          |
| Electro-gravimetric analysis:principle,important terms in electrogravimetry,decomposition voltage or decomposition potential,over voltage and their importance,instrumentation,electrolysis at constant current.  |
| Determination of Cu(II) by constant current electrolysis,electrolysis at controlled potentials,determination of Cu,Pb,Sn in brass and bronze by controlled potential electrolysis.                                |
| Reductant system-principles and applications in analysis:analytical chemistry of some selected reductant systems-formal.  |
| Standard and normal potential in various media,stability of the solutions,species responsible for the reduction properties.   |
| Standardisation,requirement for the selection of the reductants,selection of suitable indicators for various reductants systems.  |
| Inorganic systems-Cr(II),V(II),Ti(III),Sn(II),Fe(II) in H <sub>3</sub> PO <sub>4</sub> and hydrazine.   |
| Organic systems-hydroquinone and ascorbic acid,Analysis of some selected drugs:basic considerations of drugs-classification.  |
| Determination of the following drugs:acetyl salicylic acid,testosterone progesterone,cortisone  |
| Determination of sulphadiazine,phenobarbitone   |
| Determination of chloramphenicol,benzyl penicillin and tetracycline,thiamine,riboflavin,ascorbic acid.  |
| Determination of Isoniazid,metyldopa,metronidazole.   |

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Syllabus for the Academic Year 2016-17

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Intorduction of applied analysis, dissolution of complex materials various de chemical methods.<br>Introduction of iron ore.   |
| Determiration of iron ore, determination manganese ore.  |
| Analysis of chromite ore and analysis of phosphate rock ore.   |
| Analysis of aluminium ore , analysis of finished product-1, analysis of steel.   |
| Analysis of blast furnance slag, analysis of refractory materials.   |
| Analysis of fluxes, analysis finished product-2, analysis of cement.   |
| Analysis of oils and analysis of soaps.  |
| Analysis of paints, introduction of water quality, standards for drinking water.   |
| Source of water, classification of water for different uses.   |
| Types of water pollutants and their affects, analytical methods, the determination of anions like $\text{CO}_3^{-2}$ , $\text{HCO}_3^-$ , $\text{Cl}^-$ , $\text{F}^-$ |
| Analysis of anions $\text{SO}_4^{-2}$ , $\text{PO}_4^{-3}$ , $\text{NO}_3^-$ , $\text{NO}_2^-$ ,   |
| Determination of anions is cynide, sulphide, determination of cations like $\text{Fe}^{+2}$ , $\text{Fe}^{+3}$ $\text{Ca}^{+2}$ , $\text{Mg}^{+2}$ .                   |
| Determination of cations $\text{Cr}^{+3}$ , $\text{As}^{+5}$ .   |
| Determination of cations $\text{Pb}^{+2}$ , $\text{Hg}^{+2}$ , $\text{Cu}^{+2}$ .  |
| Determination of cations $\text{Zn}^{+2}$ , $\text{Cd}^{+2}$ , $\text{Co}^{+2}$ .  |
| Determiration of D.O,B.O.D,C.O.D.  |
| Standards for drinking water, general introduction, uses and application of water quality.   |
| Saponification number,iodine number,acid number,diffirent uses for the assessment of water quality   |

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Syllabus for the Academic Year 2016-17

Department:P.G. ANALYTICAL CHEMISTRY

Paper:Applied Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Introduction of analysis of raw materials,analysis of non-ferrous alloys,analysis of ferro alloys   |
| Analysis of brass,analysis of bronze,analysis of solder   |
| Analysis of ferro silicon constituents are si,c,p,s;analysis of ferro vanadium constituents are v,c,p,s,si,Al   |
| Analysis of ferro manganese,analysis of silico manganese  |
| Introduction of analysis of soils,fertilizers and fuel  |
| Analysis of soils:sampling,determination of moisture,total N,P,Si,lime,humus nitrogen,alkali salts,soil absorption ratio.   |
| Analysis of fertilizer:ammonical fertilizers,phosphate fertilizes,nitrate fertilizers   |
| Analysis of fuels:sold fuels-coal,proximate analysis,ultimate analysis,heating value,grading of coal based on ultimate heat value{UHV}  |
| Assessment oair quality:composition opure air,classification of air pollutants,toxic elements presents in dust and their sources  |
| Collection of air samples,sources,effects,control of pollution and chemical analysis for the following  |
| Primary pollutants:carbon compounds-(CO),carbon dioxide,sulphur compounds:sulphur dioxide,sulphur trioxide,hydrogen sulphide  |
| Nitrogen compounds:nitric oxide,nitrogen dioxide,hydrocarbons:-aliphatic hydrocarbons&polycyclic aromatic hydrocarbons  |
| Particulate matter-repairable&suspended particulate matter,inorganic&organic particulates   |
| Secondary pollutants-ozone,peroxy acetyl nitrate,peroxy benzyl nitrate;standards for amient air quality   |
| Kinetic methods of analysis:introduction,slow reactions,catalyzed reactions   |
| Methods of determination of catalyst concentration,extrapolation methods for the determination of catalyst,variable time method,fixed time method   |
| Examples for the determination of toxic metals and anions using some typical kinetic reactions.Non aqueous titrimetry:classification of solvents and titrations for non aqueous titrimetry. |
| Types of reactions-indicators:determination of acids,determination of bases,karl-fisher reagent for the determination of moisture content in drugs and other samples                        |

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Syllabus for the Academic Year 2016-17

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-I

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:III

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| Laws of absorption, deviations from beer's law, single and double beam, spectrometers.   |
| Instrumentation , sources of radiation detectors qualitative analysis by absorption measurements , general precautions in colorimetric determination,.   |
| Spectro photometric titrations, principle of diode array detector determination of $Fe^{+2}$ , and $Fe^{+3}$ .   |
| Determination of $Al^{+3}$ , $NH_4^+$ , $Cr^{+3}$ , $Cr^{+6}$ , $Co^{+3}$ , $Cu^{+2}$ , $Ni^{+2}$ , $NO_2^-$ , $PO_4^{-3}$ , Simultaneous determination of $KMnO_4$ and $K_2Cr_2O_7$ . Theory of fluorescence and phosphorescence, factors affecting these two, principle and instrumentation of Spectrofluorimetry. |
| Units of frequency, wavelength, and wave number, molecular vibrations factors influencing frequencies, instrumentation of IR spectroscopy.   |
| Sampling techniques detectors in IR, qualitative and quantitative analysis with reference to selected molecules like CO and $CO_2$ .   |
| Non destructive IR method for the analysis of CO and other organic compounds, principle of FT-IR.  |
| Theory of Raman spectroscopy and instrumentation and Raman spectra of CO, $CO_2$ , $N_2O$ and $H_2O$ , Differences between Raman spectra and IR spectra.   |
| Resonance condition, Origin of NMR spectra, factors affecting chemical shift, shielding and de shielding.  |
| Spin-spin coupling, interpretation of NMR spectra of organic compounds factors influencing NMR spectra Fast chemical reactions   |
| Magnitude of I, nuclei with Quadrapole moments FT-NMR Study of isotopes other than proton $^{13}C$ $^{15}N$ , $^{19}F$ , $^{31}P$ , $^{11}B$ double resonance, shift reagents, Spin tickling and applications.   |
| Theory of ESR and instrumentation , g-value, hyperfine splitting qualitative analysis, Kramer's degeneracy.  |
| Instrumentation of ESR differences between ESR and NMR spectra. Qualitative analysis, study of free radicals and other applications.   |
| Mass spectroscopy principle and ion sources, inlets, detectors.  |
| Types of peaks, observed resolution qualitative analysis molecular weight determination  |
| Quantitative analysis, advantages chemical analysis of X-RF matrix effects, advantages of X-RF wave length, dispersive technique and evaluation methods.   |
| X-RF energy dispersive technique and evaluation method, applications. Instrumentation of X-RF, matrix effects, and its advantages  |

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Syllabus for the Academic Year 2016-17

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-II

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:IV

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| Flame photometry theory, instrumentation combustion flames, detectors, and analysis of Na, K ,Ca and Mg, atomic absorption spectrometer theory and instrumentation, flame techniques.  |
| Resonance line sources, hollow cathode lamp chemical and spectral interferences. applications with special reference to analysis of trace metal in oils, allows and toxic metals in drinking water and effluents.  |
| ICP-AES, ICP-MS principles, instrumentation of plasma, AES detectors, quadra-pole mass spectrometers, differences between the two detectors.   |
| Applications of liquids and solids, applications in the analysis of trace and toxic metals in water geological and industrial samples, arc and spark spectrographic direct analysis of solid for metals.   |
| Thermo Gravimetry theory, instrumentation and applications, with special reference to $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , $\text{CaCO}_3$ , $(\text{COOH})_2$ . differential thermal analysis- principle, instrumentation, difference between TG and DTA. |
| DTA-applications with special reference to the clays and minerals coals (fuels), differential scanning calorimetry - principle, instrumentation and applications to inorganic materials like chlorates and per chlorates   |
| Determination of ammonium nitrate organic compound and drugs by using DSC. Principle of Polarography, , residual current, migration current ,diffusion current, half wave potential ILKOVIC equation and DME instrumentation.  |
| Advantages & disadvantages, qualitative and quantitative analysis of inorganic ions Cu, Bi , Pb,Cd and Zn. AC polarography, pulse polarography   |
| Principle, instrumentation of HMDE application in the analysis of Pb and Cd in environmental samples.  |
| Principle of cathode stripping voltametry principles of coulometric analysis with constant current coulometric analysis of cations- As(III),Fe(II).  |
| Determination I and S <sup>-2</sup> by using I <sub>2</sub> liberations and Ce <sup>+4</sup> liberation in solutions coulometric analysis with controlled potentials.  |
| Reference electrodes- hydrogen electrode calomel electrode, silver chloride.   |
| Indicator electrodes- hydrogen electrode, glass electrodes, theory of membrane potentials and glass electrodes, theory of membrane potentials and liquid junction potentials, calibration of ion selective electrodes.   |
| Ion selective electrodes with fixed membrane sited Ag, Pb, Cd, S, F, CN and glass electrodes applications in the analysis of air and water.  |
| Detection and measurements of radio activity introduction to radioactive traces applications of tracer technique.  |
| Isotope dilution analysis applications activation analysis applications advantages disadvantages radio carbon dating technique.  |



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Syllabus for the Academic Year 2015-16

Department:P.G.ANALYTICAL CHEMISTRY

Paper: GENERAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Wave equation-interpretation of wave function-properties of wave function-Normalisation and orthogonalisation   |
| Operators-Linear and Non linear ,Commutators of Operators   |
| Postulates of Quantum mechanics,Setting up of operators obserbables   |
| Hermitian operator-Eigen values of hermitian operator   |
| Basic quantum chemistry-II; Wave mechanics of simple systems with constant potential energy ,partical in one dimensional box .  |
| Factors influencing color transition –dipole integral , symmetry arguments in deriving the selection rules.   |
| Wave mechanics of systems with variable potential energy –symple harmonic oscillator , solution of wave equation-selection rules.   |
| calculation of bond length –isotopic effect,second order stark effect and its applications  |
| Molecular spectroscopy-I;Rotational spectra of diatomic molecules-Rigid rotor Selection rules- calculation of bond length –isotopic effect,second order stark effect and its applications |
| Infrared spectra of diatomic molecules , harmonic and anharmonic oscillators –selection rules.  |
| Overtone combination bands – calculation of force constant , anharmonicity constant and zero point energy.  |
| Fermi resonance ,simultaneous vibration-rotation spectra of diatomic molecule .   |
| Molecular spectroscopyII-Raman effect –classical and quantum mechanical explanations  |
| Franck Condon principle –applications ,Rotational fine structure . Charge transfer spectra-band head and band shading   |

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Syllabus for the Academic Year 2015-16

Department : P.G.ANALYTICAL CHEMISTRY

Paper :GENERAL CHEMISTRY-I

Class: I M.SC ANALYTICAL CHEMISTRY

Semester:II

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|---|
| Basic Quantum chemistry III-Hydrogen atom ,probability density in orbitals ,shapes of orbitals .  |
| Perturbation theory- line independent perturbation theory Only first order perturbation is to be dealt with   |
| Application to ground state energy of Helium atom . Variation principle –Application – Calculation  |
| Symmetry operations and point groups, classification of molecules in to point groups.   |
| Group theory – group multiplication table for C <sub>2v</sub> and C <sub>3v</sub> point groups.   |
| Representations, reducible and irreducible representations, Mulliken symbols, orthogonality theorem and its implications                              |
| Treatment of analytical data, classification of errors, determinations of indeterminate errors, minimisation of errors- absolute and relative errors, |
| Standard deviations- standard error of mean – student' t-test, testing for significance – comparison of two means – f –tes.                           |
| Basic quantum chemistry -4; Valence bond approach –directed valence hybridization .   |
| Calculation of ionic and covalent bond contribution in hydrogen molecule  |
| Molecular orbital theory- LCAO approximation –hydrogen molecule ion   |
| Hydrogen molecule (fundamental concepts only) –The electronic transition in the hydrogen molecule .   |
| Computer languages operating systems – principles of algorithms and flow charts.  |
| Arithmetic expressions – arithmetic statements- replacement statements – IF statements.   |
| Logical IF and block IF statements – GOTO statements, subscripted, variable and DIMENSION statement   |
| DO statement – rules for DO statements, functions and subroutines-development of FORTRAN statements for simple formula in chemistry.                  |
| Wander wall equation, pH of solution – first order rate equation – cell constant – electrode potential.   |

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**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-I**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:I**

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| Structure & Bonding:Application of VSEPR ,Valence bond theory and applications.   |
| Molecular orbital theories,Structure of Simple molecules.   |
| Applications of MO theory to Square planar &Octahedral complexes.   |
| Walsh diagram for water molecule.   |
| Coordination compounds;Crystal field theory- Crystal field splitting patterns in octahedral,tetrahedral,tetragonal ,square planar,trigonal bipyramidal geometries.                  |
| Calculations of CFSE, Factors affecting crystal field splitting energies ,spectrochemical series .  |
| Jahn-Teller effect, Nephelauxetic effect, ligand field theory .   |
| Term symbols –Russell sanders coupling, derivation of term symbols for various configurations .Spectroscopic ground states.   |
| Inorganic cage and ring compounds; Preparation ,structure and reactions of boranes , carboranes.  |
| Preparation , structure and reactions of metallocarboranes ,boron-nitrogen cyclic compounds .   |
| Phosphorus-nitrogen and sulphur- nitrogen cyclic compounds .  |
| Electron counting in boranes –Wades rules.Isopoly and Heteropoly acids.   |
| Electronic spectra of transition metal complexes;Selection rules ,break down of selection rules Orgel diagrams,T-S diagrams for $d^1$ - $d^9$ Octahedral and tetrahedral complexes. |
| Charge transfer spectra , Quenching of orbital momentum .   |

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Syllabus for the Academic Year 2015-16

**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-II**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:II**

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|---|
| Metal cluster compounds –Definition –evidences for existence of M-M bonds conditions favourable for formation of M-M bonds  |
| Classification of binuclear cluster compounds ,Confacial bioctahedron structures  |
| Trinuclear cluster compounds and polynuclear cluster compounds  |
| Polyatomic clusters –Zintl ions, Chevrel phases.  |
| Organo metallic compounds :16 and 18 electrons rules, isolobal relationship   |
| Iso electron relationship- synthesis structure and bonding of carbon monoxide dinitrogen and nitric oxide complexes.  |
| Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.  |
| Classification metal carbonyls.   |
| Metal ligand equilibrium in solution: step wise and overall formation constants, factors effecting the stability metal complexes.                                     |
| Pearson's theory of hard and soft acids and bases, chelate effect, determination of stability constant.   |
| Inert and labile complexes, explanation of lability on the basis of VBT and CFT. biological and abiological nitrogen fixation.  |
| Metallo porphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to $Ca^{+2}$ . |
| Inorganic reaction mechanisms: ligand replacement reactions of metal complexes, acid hydrolysis- factors effecting acid hydrolysis.                                   |
| Acid and base hydrolysis of cobalt (III) complexes, ligand displacement reactions of square planar complexes of Pt(II).   |
| Factors effecting square planar substitutions – trans effect, complementary and non complementary reactions with examples.  |
| Electron transfer reactions of complexes- inner and outer sphere mechanisms.  |

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Syllabus for the Academic Year 2015-16

Department :P.G.ANALYTICAL CHEMISTSRY

Paper :ORGANIC CHEMISTRY-I

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:I

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| Localised and delocalised covalent bond, concept of resonance, aromaticity, Huckle's rule.  |
| Benzenoid and non benzenoid compounds, anto aromaticity, homo aromaticity, nature of reaction energy and kinetic considerations.  |
| Types of organic reactions, reagents, reactive intermediates, formation and stabilization, inductive and mesomeric effects.   |
| Stereo chemistry conformational isomerism, acyclic and simple systems, substituted ethanes.   |
| Cyclo pentane, cyclo hexane, cyclo heptanes, cyclo octane and decalins.   |
| Optical isomerism, optical activity, molecular dissymmetry and chirality, elements of symmetry.   |
| Fisher's projection, D,L and R,S configurations, relative absolute configurations, optical isomerism due to asymmetric carbon atoms, bi phenyls allenes, spirans, racemisation, resolution. |
| Geometrical isomerism, E,Z configurations, properties.  |
| Hetero cyclic compounds, synthesis and reactivity of pyridine, quinoline, iso quinoline.  |
| Indole, benzo furan, benzo thiofene, pyrazole.  |
| Imidazole, oxazole, isoxazole, thiazole, isothiazole, pyridazine, pyrimydine, pyrazine  |
| Chemistry of some typical natural products, isolation, structure, elucidation, synthesis and bio genesis of the following compounds,flavonoids.   |
| Quercetin, cyanidin, genestein, terpenoids.   |
| Alpha terpeneol, alpha pinene, camphor, farnesol.   |

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Syllabus for the Academic Year 2015-16

Department :P.G.ANALYTICAL CHEMISTRY

Paper :ORGANIC CHEMISTRY-II

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:II

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| Aromatic substitution reactions, electrophilic, nucleophilic and through benzyne, radical substitution of arenes.                                       |
| Orientation of nucleophilic substitution at saturated carbon, SN1, SN2.   |
| SNi reactions, effect of structure, nucleophile, leaving group, solvent, addition, involving, electrophiles, nucleophiles and free radicals.            |
| Elimination reactions, E1, E1cB, E2 reactions, elimination versus substitution reactions.   |
| Mechanism of some named reactions, Aldol, Perkin, Benzoin, Cannizzaro reactions   |
| Wittig, Grignard, Reformatsky, Meerwein, Hoffmann, Claisen rearrangements.  |
| Favorsky rearrangement, hydroboration, openauer oxidation, clemmensen reduction, meerwein-pondorf and verley, birch reduction, stork enamine reactions. |
| Michael addition, mannich reaction, Diel's -Alder reaction, Ene reaction, Bayer- Villiger reaction,   |
| Spectra and structure, application of organic spectroscopy, UV Spectroscopy.  |
| IR spectroscopy, basic principles and importance.   |
| PMR spectroscopy, basic principles and importance.  |
| Mass spectroscopy, basic principle and importance.  |
| Isolation, structure, elucidation and synthesis of alkaloids, atropine, nicotine, quinine.  |
| Purines, caffeine, configuration.   |
| Ring structure and explanation of glucose.  |
| Ring structure and explanation of fructose, anomeric effects.   |

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Bhimavaram, W.G.Dist, A.P

Syllabus for the Academic Year 2015-16

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Thermodynamics:concepts of partial molar properties, graphical methods, intercept method and apparent molar volume method.   |
| Chemical potential with T&P Gibbs Duhem equation phase rule from the concept of chemical potential, thermodynamic properties of ideal solutions.   |
| Raoult's law, Henry's law, non ideal systems, concept of fugacity, non ideal solutions, activities and activity coefficients.  |
| Determination activity coefficient from vapour pressure measurement, chemical equilibrium, effect temp on equilibrium constant, Vant hoff equation.                                      |
| Micelles and macro molecules: classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration.  |
| Factors affecting CMC, thermodynamics of micellization , phase separation and mass action models, solubilization, micro emulsions, reverse micelles.                                     |
| Polymers, types of polymers, electrically conducting polymer, liquid crystal polymers, kinetics of free radical polymerization, molecular mass number and mass average molecular weight. |
| Weight determination - end group analysis, osmometry, viscometry, light scattering methods.  |
| Chemical kinetics, collision theory, transition state theory Debye Huckel theory, salt effects.  |
| Hammett equation, Taft equation, consecutive reactions, parallel reactions, opposing reactions.  |
| Acid -base catalysis, Arrhenius diagram, fast reactions flow methods.  |
| Photochemistry: Franck Condon principle, excited molecules, singlet and triplet states, spin orbit interactions, actinometry, ferrioxalate and uranyl oxalate actinometers - problems.   |
| Derivation of fluorescence and phosphorescence, quantum yields, quenching affect, Stern Volmer equation.   |
| Primary process, types of photochemical reactions, photodissociation, additional isomerisation reactions with examples.  |

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Syllabus for the Academic Year 2015-16

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-II

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:II

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| NMR-Principle and Theory Introduction.  |
| Nature of spinning particle and its interaction with magnetic field.Chemical shift&origin spin-spin interaction,Application of NMR to structural elucidation.               |
| Electron spin resonance-principle and experimental technique –g-factor,Line shapes&Line widths hyperfine interactions.  |
| Applications of ESR studies.dimethylformamide,styrene   |
| Brief review on Entropy changes accompanying specific process-expansion,phase transition,heating measurement of Entropy.  |
| Nernst heat theorem,Third law of thermodynamics-Determination of the absolute entropy.  |
| Types of ensembles,thermodynamic probability,most probable distribution law –partition function,molar&molecular partitions.   |
| Rotational,translational,vibrational&electronic partition function –relation between thermodynamic function (E,H,S,G&Cv)and the partition.                                  |
| Electrochemistry-Electrochemical cell –Galvanic&Electrolytical cell.Concentration cell with&without transference,effect of complexation on redox potential.                 |
| Ferricyanide\ferrocyanide couple,Iron(III) .free radicals,metal complexes and biological systems. phenanthroline/Iron(II) phenanthroline couple.                            |
| Determination of standard potential,solubility product equilibrium constant&activity coefficients from EMF data.  |
| Bjerrum theory of ion association concept of activity and activity coefficients in electrolytic solutions.  |
| The mean ionic activity coefficient,Debye-Huckel theory of electrolytic solutions,Limiting law.   |
| Calculation of mean ionic activity coefficient,limitations of Debye-Huckel theory.  |
| Effect of dilution on equivalent conductance of electrolytes,anomalous behavior of strong electrolyte.Debye-Huckel Onsagar equation-verification and limitations,fuel cell. |
| Electrochemistry-II the electrode-electrolyte interface.primary and secondary cells,batteries examples.   |
| The electric double layer.The Helmholtz-Perrin parallel-plate model,The Gouy-chapman diffuse-charge model&the stern.  |



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Department :P..G.ANALYTICAL CHEMISTRY  
 Class: II M.Sc.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-I  
 Semester:III

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| Classification different chromatographic methods, theory of chromatography, development techniques elution, gradient elution, displacement and frontal analysis |
| Chromatography phenomena migration, adsorption, partition adsorption coefficient retardation factor, retention time and volume.                                 |
| Partition isotherms, zone spreading, column capacity, temp effects, efficiency of chromatography column.  |
| HETP, Vandemeter equation resolution choice of column length, flow velocity, qualitative and quantitative analysis.   |
| Principle of column chromatography adsorption isotherms chromatographic media nature of forces between sample and stationary phase.                             |
| Column chromatography without detectors and liquid chromatography with detectors and application.   |
| Principles of gel exclusion chromatography properties of xerogels apparatus and detectors resolution.   |
| Principles of capillary electrophoresis, instrumentation applications to inorganic and organic compounds.   |
| Gas chromatography principle Instrumentation, columns detectors thermal conductivity, flame ionization electron capture,N-P detector.                           |
| Photo ionization, temp programming of G.C and applications structure of zeolites crystals types of sieves.  |
| Application in the separation of gases including hydrocarbons ion exclusion principles and applications.  |
| Affinity chromatography principle and applications, GC-MS Principle and instrumentation and applications of GC-MS   |
| Liquid-liquid partition chromatography principle, supports partition liquids, eluents, reverse phase chromatography apparatus applications, HPLC theory.        |
| HPLC instrumentation, columns UV detector, RF detector, Fluorescence, diode array detector, .applications in the separation of organic compounds.               |
| Applications in the separation of organic compounds, names of other detectors used their principles and applications.   |
| LC-MS principle and instrumentation LC-MS data ion Chromatograms, selected ion monitoring.  |
| Processing LC-MS data, ion chromatograms, library searching quantitative measurements.  |
| Applications of LC-MS for Drug analysis, Environmental Samples and others.  |

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Department :P.G.ANALYTICAL CHEMISTRY  
 Class:II M.Sc.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-II  
 Semester:IV

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| Paper chromatography principle, chromatographic medium, modified papers, solvent, systems mechanism of paper chromatography, experimental technique different development methods.   |
| Desending, horizontal circular spreading multiple development, two dimensional development, reverse phase chromatographic technique visualization chromatograms.   |
| Thin layer chromatography principle, media coating materials, applications simple development, solvent systems development of chromatoplate types of development of chromatoplate types of development visualization methods documentation applications in the separation HPTLC principle, technique applications. |
| Ion exchange chromatography principles systematic ion exchange resins properties of anion and cation exchange resin, ion exchange mechanism equilibria, selectivity, ion exchange capacity, applications of ion exchangers.  |
| In different fields, principles of ion exchange systems, equipment application specifically separations of lanthanides, actinides, amino acids , Ion chromatography principles o f separation instrumentation, detectors.  |
| Separation of cations and anions applications in the analysis of water and air pollutants,. Basis of sampling, purpose of sampling homogenous and heterogeneous samples.   |
| Statistical criteria for good sampling sample size sampling unit, gross sample, Laboratory sample, sampling of solids, cone and quartering method.   |
| Long pile and alternative shovel method.   |
| Precautions in preservation of solid samples, sampling of metals and other solids rods wires, sheets, plates especially gold, silver, iron and other metals.   |
| Sampling of different types of liquids and techniques, sampling of drinking water industrial effluents. precautions in sampling and preservation of collected liquids.   |
| Sampling of gases and preconcentration by adsorption or absorption mehod instantaneous monitoring, precautions.  |
| In preservation of samples, systematic sampling and random sampling importance of analytical chemistry   |
| To industrial research and development industries and other branches of science, development and validation of an analytical method.   |
| Units concentrations calculations, standards, chemical reactions, importance of separation methods with examples. principles and processes of solvent extraction, distribution law and partition coefficient, nature of partition forces.  |
| Different types of solvent extraction , solvent extraction systems, applications in metallurgy, general application in analysis and pre- concentration.  |
| Special extraction systems like crown ethers, super fluid and surfactant extractions- examples.  |

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Syllabus for the Academic Year 2015-16

Department:P.G.ANALYTICAL CHEMISTRY

Paper:QC&Traditional Methods of Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Classification of functional groups with suitable examples,Determination of functional groups imparting acidic nature-Thiol,Endiol.   |
| Determination of imparting acidic nature-Phenolic hydroxyl.Determination of imparting basic nature Aliphatic&Aromatic amines.Difference b/w Aliphatic and Aromatic Amines.                |
| Determination of Primary,Secondary,Tertiary Amines&Hydride derivatives.   |
| Functional groups which imparting neither acidic nor basic nature-Aldehydes,Ketones,Nitro group,Methoxy,Alifinic group.   |
| Characteristics of an analysis-LOD,Sensitivity,Safety,Cost measurability,Selectivity&Specificity.   |
| Classification of errors,minimization of errors,ISO 9000 series,ISO 14000 series.   |
| Good laboratory practices&ICH guide lines on drug substances&products,control charts.   |
| Accuracy,precision,significant figures,normal distribution,F-test   |
| Oxidant systems-Principles &Applications in Analysis-Inorganic systems Mn(III),Mn(VII),Ce(IV),Cr(VI)is determined.  |
| Determination of Inorganic systems V(v),Periodate,Iodate.Organic systems Chloramine-T.Oxidant properties and indicators.  |
| Organic compounds Principles of solubility of organic compounds,Non polar,Polar solvents.Recrystallisation method and applications of solubility and recrystallisation.                   |
| Inorganic compounds definition of dissolution &decomposition.Principles of decomposition &dissolution,difference b/w Dissolution&decomposition. Decomposition with H <sub>2</sub> O,HCl . |
| Decomposition with HF,HNO <sub>3</sub> ,H <sub>2</sub> SO <sub>4</sub> &HClO <sub>4</sub>   |
| Definition of fusion &Sintering.Difference b/w fusion & sintering &fusion with sintering with decomposition with examples.  |
| Decomposition techniques and parameters needs to be consider in the decomposing the samples for Analysis.   |
| Absorption of microwave energy and heating .Explain the ultrasonic assisted extraction.   |
| Statistical analysis –Mean deviation,standard deviation,coefficient of variance,T-test,Ruggedness test,Youden plot,Ranking test.  |
| Computations and propagation of errors representation of data,production and service elements of quality assurance,quality and quantity management system ,control tools.                 |

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Syllabus for the Academic Year 2015-16

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Traditional Methods of Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Precipitation methods-I:crystal habit &super saturation,nucleation and crystal growth,homogeneous&heterogeneous nucleation,solubility and particle size,colloids,completeness of precipitation                    |
| Effect of excess precipitant,ph,complex formation,temperature,purity of precipitates,aging.Co-precipitation & post precipitation:theory of adsorption of salts having an ion in common with the main precipitate. |
| Co-precipitation in colloidal precipitates,adsorption of solvents,mixed crystal formation by occlusion and entrapment,re-precipitation with examples,post-precipitation-theory of post-precipitation              |
| Examples of post precipitation,conditions for obtaining pure and quantitative precipitates.Precipitation titrations:principle,indicators for precipitation titrations,determination of halides.                   |
| Precipitation from homogeneous solution(PFHS):theory of PFHS,methods of PFHS-increase in pH,decrease in pH,cation release,anion release,reagent synthesis.  |
| Change in oxidation state,photochemical reactions,precipitation from mixed solvents,applications of PFHS methods.Gravimetric determinations:nature of species,preparation of solutions,limitations.               |
| Interferences,inorganic precipitants-chloride and sulphates,organic precipitants dimethyl glyoxime ,oxime,benzidine,salicyladoxime,benzoin oxime,sodium tetraphenyl boron,tetraphenyl arsonium chloride.          |
| Electro-gravimetric analysis:principle,important terms in electrogravimetry,decomposition voltage or decomposition potential,over voltage and their importance,instrumentation,electrolysis at constant current.  |
| Determination of Cu(II) by constant current electrolysis,electrolysis at controlled potentials,determination of Cu,Pb,Sn in brass and bronze by controlled potential electrolysis.                                |
| Reductant system-principles and applications in analysis:analytical chemistry of some selected reductant systems-formal.  |
| Standard and normal potential in various media,stability of the solutions,species responsible for the reduction properties.   |
| Standardisation,requirement for the selection of the reductants,selection of suitable indicators for various reductants systems.  |
| Inorganic systems-Cr(II),V(II),Ti(III),Sn(II),Fe(II) in H <sub>3</sub> PO <sub>4</sub> and hydrazine.   |
| Organic systems-hydroquinone and ascorbic acid,Analysis of some selected drugs:basic considerations of drugs-classification.  |
| Determination of the following drugs:acetyl salicylic acid,testosterone progesterone,cortisone  |
| Determination of sulphadiazine,phenobarbitone   |
| Determination of chloramphenicol,benzyl penicillin and tetracycline,thiamine,riboflavin,ascorbic acid.  |
| Determination of Isoniazid,metyldopa,metronidazole.   |

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Syllabus for the Academic Year 2015-16

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Intorduction of applied analysis, dissolution of complex materials various de chemical methods. Introduction of iron ore.  |
| Determiration of iron ore, determination manganese ore.  |
| Analysis of chromite ore and analysis of phosphate rock ore.   |
| Analysis of aluminium ore , analysis of finished product-1, analysis of steel.   |
| Analysis of blast furnance slag, analysis of refractory materials.   |
| Analysis of fluxes, analysis finished product-2, analysis of cement.   |
| Analysis of oils and analysis of soaps.  |
| Analysis of paints, introduction of water quality, standards for drinking water.   |
| Source of water, classification of water for different uses.   |
| Types of water pollutants and their affects, analytical methods, the determiration of anions like $\text{CO}_3^{-2}$ , $\text{HCO}_3^-$ , $\text{Cl}^-$ , $\text{F}^-$ |
| Analysis of anions $\text{SO}_4^{-2}$ , $\text{PO}_4^{-3}$ , $\text{NO}_3^-$ , $\text{NO}_2^-$ ,   |
| Determiration of anions is cynide, sulphide, determiration of cations like $\text{Fe}^{+2}$ , $\text{Fe}^{+3}$ $\text{Ca}^{+2}$ , $\text{Mg}^{+2}$ .                   |
| Determiration of cations $\text{Cr}^{+3}$ , $\text{As}^{+5}$ .   |
| Determiration of cations $\text{Pb}^{+2}$ , $\text{Hg}^{+2}$ , $\text{Cu}^{+2}$ .  |
| Determiration of cations $\text{Zn}^{+2}$ , $\text{Cd}^{+2}$ , $\text{Co}^{+2}$ .  |
| Determiration of D.O,B.O.D,C.O.D.  |
| Standards for drinking water, general introduction, uses and application of water quality.   |
| Saponification number,iodine number,acid number,diffirent uses for the assessment of water quality   |

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Syllabus for the Academic Year 2015-16

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Introduction of analysis of raw materials,analysis of non-ferrous alloys,analysis of ferro alloys   |
| Analysis of brass,analysis of bronze,analysis of solder   |
| Analysis of ferro silicon constituents are si,c,p,s;analysis of ferro vanadium constituents are v,c,p,s,si,Al   |
| Analysis of ferro manganese,analysis of silico manganese  |
| Introduction of analysis of soils,fertilizers and fuel  |
| Analysis of soils:sampling,determination of moisture,total N,P,Si,lime,humus nitrogen,alkali salts,soil absorption ratio.   |
| Analysis of fertilizer:ammonical fertilizers,phosphate fertilizes,nitrate fertilizers   |
| Analysis of fuels:sold fuels-coal,proximate analysis,ultimate analysis,heating value,grading of coal based on ultimate heat value {UHV}   |
| Assessment oair quality:composition opure air,classification of air pollutants,toxic elements presents in dust and their sources  |
| Collection of air samples,sources,effects,control of pollution and chemical analysis for the following  |
| Primary pollutants:corbon compounds-(CO),carbon dioxide,sulphur compounds:sulphur dioxide,sulphur trioxide,hydrogen sulphide  |
| Nitrogen compounds:nitric oxide,nitrogen dioxide,hydrocarbons:-aliphatic hydrocarbons&polycyclic aromatic hydrocarbons  |
| Particulate matter-repairable&suspended particulate matter,inorganic&organic particulates   |
| Secondary pollutants-ozone,peroxy acetyl nitrate,peroxy benzyl nitrate;standards for amient air quality   |
| Kinetic methods of analysis:introduction,slow reactions,catalyzed reactions   |
| Methods of determination of catalyst concentration,extrapolation methods for the determination of catalyst,variable time method,fixed time method   |
| Examples for the determination of toxic metals and anions using some typical kinetic reactions.Non aqueous titrimetry:classification of solvents and titrations for non aqueous titrymetry. |
| Types of reactions-indicators:determination of acids,determination of bases,karl-fisher reagent for the determination of moisture content in drugs and other samples                        |

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Syllabus for the Academic Year 2015-16

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-I

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:III

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| Laws of absorption, deviations from beer's law, single and double beam, spectrometers.   |
| Instrumentation , sources of radiation detectors qualitative analysis by absorption measurements , general precautions in colorimetric determination,.   |
| Spectro photometric titrations, principle of diode array detector determination of $Fe^{+2}$ , and $Fe^{+3}$ .   |
| Determination of $Al^{+3}$ , $NH_4^+$ , $Cr^{+3}$ , $Cr^{+6}$ , $Co^{+3}$ , $Cu^{+2}$ , $Ni^{+2}$ , $NO_2^-$ , $PO_4^{-3}$ , Simultaneous determination of $KMnO_4$ and $K_2Cr_2O_7$ . Theory of fluorescence and phosphorescence, factors affecting these two, principle and instrumentation of Spectrofluorimetry. |
| Units of frequency, wavelength, and wave number, molecular vibrations factors influencing frequencies, instrumentation of IR spectroscopy.   |
| Sampling techniques detectors in IR, qualitative and quantitative analysis with reference to selected molecules like CO and CO <sub>2</sub> .  |
| Non destructive IR method for the analysis of CO and other organic compounds, principle of FT-IR.  |
| Theory of Raman spectroscopy and instrumentation and Raman spectra of CO, CO <sub>2</sub> , N <sub>2</sub> O and H <sub>2</sub> O, Differences between Raman spectra and IR spectra.   |
| Resonance condition, Origin of NMR spectra, factors affecting chemical shift, shielding and de shielding.  |
| Spin-spin coupling, interpretation of NMR spectra of organic compounds factors influencing NMR spectra Fast chemical reactions   |
| Magnitude of I, nuclei with Quadrupole moments FT-NMR Study of isotopes other than proton <sup>13</sup> C, <sup>15</sup> N, <sup>19</sup> F, <sup>31</sup> P, <sup>11</sup> B double resonance, shift reagents, Spin tickling and applications.  |
| Theory of ESR and instrumentation , g-value, hyperfine splitting qualitative analysis, Kramer's degeneracy.  |
| Instrumentation of ESR differences between ESR and NMR spectra. Qualitative analysis, study of free radicals and other applications.   |
| Mass spectroscopy principle and ion sources, inlets, detectors.  |
| Types of peaks, observed resolution qualitative analysis molecular weight determination  |
| Quantitative analysis, advantages chemical analysis of X-RF matrix effects, advantages of X-RF wave length, dispersive technique and evaluation methods.   |
| X-RF energy dispersive technique and evaluation method, applications.  |
| Instrumentation of X-RF, matrix effects, and its advantages.   |

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Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-II

Class: II M.Sc.ANALYTICAL CHEMISTRY

Semester:IV

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| Flame photometry theory, instrumentation combustion flames, detectors, and analysis of Na, K ,Ca and Mg, atomic absorption spectrometer theory and instrumentation, flame techniques.  |
| Resonance line sources, hollow cathode lamp chemical and spectral interferences. applications with special reference to analysis of trace metal in oils, allows and toxic metals in drinking water and effluents.  |
| ICP-AES, ICP-MS principles, instrumentation of plasma, AES detectors, quadra-pole mass spectrometers, differences between the two detectors.   |
| Applications of liquids and solids, applications in the analysis of trace and toxic metals in water geological and industrial samples, arc and spark spectrographic direct analysis of solid for metals.   |
| Thermo Gravimetry theory, instrumentation and applications, with special reference to $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , $\text{CaCO}_3$ , $(\text{COOH})_2$ . differential thermal analysis- principle, instrumentation, difference between TG and DTA. |
| DTA-applications with special reference to the clays and minerals coals (fuels), differential scanning calorimetry - principle, instrumentation and applications to inorganic materials like chlorates and perchlorates  |
| Determination of ammonium nitrate organic compound and drugs by using DSC. Principle of Polarography, , residual current, migration current ,diffusion current, half wave potential ILKOVIC equation and DME instrumentation.  |
| Advantages & disadvantages, qualitative and quantitative analysis of inorganic ions Cu, Bi , Pb,Cd and Zn. AC polarography, pulse polarography   |
| Principle, instrumentation of HMDE application in the analysis of Pb and Cd in environmental samples.  |
| Principle of cathode stripping voltametry principles of coulometric analysis with constant current coulometric analysis of cations- As(III),Fe(II).  |
| Determination $\text{I}^-$ and $\text{S}^{2-}$ by using $\text{I}_2$ liberations and $\text{Ce}^{+4}$ liberation in solutions coulometric analysis with controlled potentials.   |
| Reference electrodes- hydrogen electrode calomel electrode, silver chloride.   |
| Indicator electrodes- hydrogen electrode, glass electrodes, theory of membrane potentials and glass electrodes, theory of membrane potentials and liquid junction potentials, calibration of ion selective electrodes.   |
| Ion selective electrodes with fixed membrane sited Ag, Pb, Cd, S, F, CN and glass electrodes applications in the analysis of air and water.  |
| Detection and measurements of radio activity introduction to radioactive traces applications of tracer technique.  |
| Isotope dilution analysis applications activation analysis applications advantages disadvantages radio carbon dating technique.  |



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Syllabus for the Academic Year 2014-15

Department:P.G.ANALYTICAL CHEMISTRY

Paper: GENERAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Wave equation-interpretation of wave function-properties of wave function-Normalisation and orthogonalisation  |
| Operators-Linear and Non linear ,Commutators of Operators  |
| Postulates of Quantum mechanics,Setting up of operators obserbables  |
| Hermitian operator-Eigen values of hermitian operator  |
| Basic quantum chemistry-II; Wave mechanics of simple systems with constant potential energy ,partical in one dimensional box .   |
| Factors influencing color transition –dipole integral , symmetry arguments in deriving the selection rules.  |
| Wave mechanics of systems with variable potential energy –symple harmonic oscillator , solution of wave equation-selection rules.  |
| calculation of bond length –isotopic effect,second order stark effect and its applications   |
| Molecular spectroscopy-I;Rotational spectra of diatomic molecules-Rigid rotor Selection rules-calculation of bond length –isotopic effect,second order stark effect and its applications |
| Infrared spectra of diatomic molecules , harmonic and anharmonic oscillators –selection rules.   |
| Overtone combination bands – calculation of force constant , anharmonicity constant and zero point energy.   |
| Fermi resonance ,simultaneous vibration-rotation spectra of diatomic molecule .  |
| Molecular spectroscopyII-Raman effect –classical and quantum mechanical explanations   |
| Franck Condon principle –applications ,Rotational fine structure . Charge transfer spectra-band head and band shading  |

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Syllabus for the Academic Year 2014-15

Department : P.G.ANALYTICAL CHEMISTRY

Paper :GENERAL CHEMISTRY

Class: I M.SC ANALYTICAL CHEMISTRY

Semester:II

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| Basic Quantum chemistry III-Hydrogen atom ,probability density in orbitals ,shapes of orbitals .  |
| Perturbation theory- line independent perturbation theory Only first order perturbation is to be dealt with   |
| Application to ground state energy of Helium atom . Variation principle –Application – Calculation  |
| Symmetry operations and point groups, classification of molecules in to point groups.   |
| Group theory – group multiplication table for $C_{2v}$ and $C_{3v}$ point groups.   |
| Representations, reducible and irreducible representations, Mulliken symbols, orthogonality theorem and its implications                              |
| Treatment of analytical data, classification of errors, determinations of indeterminate errors, minimisation of errors- absolute and relative errors, |
| Standard deviations- standard error of mean – student' t-test, testing for significance – comparison of two means – f –tes.                           |
| Basic quantum chemistry -4; Valence bond approach –directed valence hybridization .   |
| Calculation of ionic and covalent bond contribution in hydrogen molecule  |
| Molecular orbital theory- LCAO approximation –hydrogen molecule ion   |
| Hydrogen molecule (fundamental concepts only) –The electronic transition in the hydrogen molecule .   |
| Computer languages operating systems – principles of algorithms and flow charts.  |
| Arithmetic expressions – arithmetic statements- replacement statements – IF statements.   |
| Logical IF and block IF statements – GOTO statements, subscripted, variable and DIMENSION statement   |
| DO statement – rules for DO statements, functions and subroutines-development of FORTRAN statements for simple formula in chemistry.                  |
| Wander wall equation, pH of solution – first order rate equation – cell constant – electrode potential.   |

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**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-I**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:I**

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| Structure & Bonding:Application of VSEPR ,Valence bond theory and applications.   |
| Molecular orbital theories,Structure of Simple molecules.   |
| Applications of MO theory to Square planar &Octahedral complexes.   |
| Walsh diagram for water molecule.   |
| Coordination compounds;Crystal field theory- Crystal field splitting patterns in octahedral,tetrahedral,tetragonal ,square planar,trigonal bipyramidal geometries.                  |
| Calculations of CFSE, Factors affecting crystal field splitting energies ,spectrochemical series .  |
| Jahn-Teller effect, Nephelauxetic effect, ligand field theory .   |
| Term symbols –Russell sanders coupling, derivation of term symbols for various configurations .Spectroscopic ground states.   |
| Inorganic cage and ring compounds; Preparation ,structure and reactions of boranes , carboranes.  |
| Preparation , structure and reactions of metallocarboranes ,boron-nitrogen cyclic compounds .   |
| Phosphorus-nitrogen and sulphur- nitrogen cyclic compounds .  |
| Electron counting in boranes –Wades rules.Isopoly and Heteropoly acids.   |
| Electronic spectra of transition metal complexes;Selection rules ,break down of selection rules Orgel diagrams,T-S diagrams for $d^1$ - $d^9$ Octahedral and tetrahedral complexes. |
| Charge transfer spectra , Quenching of orbital momentum .   |

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Syllabus for the Academic Year 2014-15

**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-II**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:II**

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|--|
| Classification of binuclear cluster compounds ,Confacial bioctahedron structures   |
| Trinuclear cluster compounds and polynuclear cluster compounds   |
| Polyatomic clusters –Zintl ions,chevrel phases.  |
| Organo metalliccompounds :16 and18 electrons rules, isolobel relation ship   |
| Iso electron relationship- synthesis structure and bonding of carbonmonoxide dinitrogen and nitricoxide complexes.   |
| Synthesis, structure, bonding and reactions of metalosins with special reference to ferrocene.   |
| Classification metal carbonyls.  |
| Metal ligand equilibrium in solution: step wise and overall formation constants, factors effecting the stability metal complexes.                                    |
| Pearsons theory of hard and soft acids and basis, chelate effect, determination of stability constant.   |
| Inert and labile complexes, explanation of lability on the basis of VBT and CFT.biological and abiological nitrogen fixation.  |
| Metalo porphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to $Ca^{+2}$ . |
| In organic reaction mechanisms:ligand replacement reactions of metal complexes, acid hydrolysis- factors effecting acid hydrolysis.                                  |
| Anation and base hydrolysis of cobalt (III)complexes, ligand displacement reactions of square planar complexes of Pt(II).  |
| Factors effecting square planar substitutions – trans effect, complementary and non complementary reactions with examples.   |
| Electron transfer reactions of complexes- inner and outer sphere mechanisms.   |

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Syllabus for the Academic Year 2014-15

Department :P.G.ANALYTICAL CHEMISTSRY

Paper :ORGANIC CHEMISTRY-I

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:I

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| Localised and delocalised covalent bond, concept of resonance, aromaticity, Huckle's rule.  |
| Benzenoid and non benzenoid compounds, anto aromaticity, homo aromaticity, nature of reaction energy and kinetic considerations.  |
| Types of organic reactions, reagents, reactive intermediates, formation and stabilization, inductive and mesomeric effects.   |
| Stereo chemistry conformational isomerism, acyclic and simple systems, substituted ethanes.   |
| Cyclo pentane, cyclo hexane, cyclo heptanes, cyclo octane and decalins.   |
| Optical isomerism, optical activity, molecular dissymmetry and chirality, elements of symmetry.   |
| Fisher's projection, D,L and R,S configurations, relative absolute configurations, optical isomerism due to asymmetric carbon atoms, bi phenyls allenes, spirans, racemisation, resolution. |
| Geometrical isomerism, E,Z configurations, properties.  |
| Hetero cyclic compounds, synthesis and reactivity of pyridine, quinoline, iso quinoline.  |
| Indole, benzo furan, benzo thiofene, pyrazole.  |
| Imidazole, oxazole, isoxazole, thiazole, isothiazole, pyridazine, pyrimydine, pyrazine  |
| Chemistry of some typical natural products, isolation, structure, elucidation, synthesis and bio genesis of the following compounds,flavonoids.   |
| Quercetin, cyanidin, genestein, terpenoids.   |
| Alpha terpeneol, alpha pinene, camphor, farnesol.   |

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Syllabus for the Academic Year 2014-15

Department :P.G.ANALYTICAL CHEMISTSRY

Paper :ORGANIC CHEMISTRY -II

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:II

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| Aromatic substitution reactions, electrophilic, nucleophilic and through benzyne, radical substitution of arenes.                                       |
| Orientation of nucleophilic substitution at saturated carbon, SN1, SN2.   |
| SNi reactions, effect of structure, nucleophile, leaving group, solvent, addition, involving, electrophiles, nucleophiles and free radicals.            |
| Elimination reactions, E1, E1CB, E2 reactions, elimination versus substitutions reactions.  |
| Mechanism of some named reactions, Aldol, Perkin, Benzoin, Cannizzaro reactions   |
| Wittig, Grignard, Reformatsky, Meerwein, Hoffmann, Claisen rearrangements.  |
| Favorsky rearrangement, hydroboration, openauer oxidation, clemmensen reduction, meerwein-pondorf and verley, birch reduction, stork enamine reactions. |
| Michael addition, mannich reaction, Diel's -Alder reaction, Ene reaction, Bayer- Villiger reaction,   |
| Spectra and structure, application of organic spectroscopy, UV Spectroscopy.  |
| IR spectroscopy, basic principles and importance.   |
| PMR spectroscopy, basic principles and importance.  |
| Mass spectroscopy, basic principle and importance.  |
| Isolation, structure, elucidation and synthesis of alkaloids, atropine, nicotine, quinine.  |
| Purines, caffeine, configuration.   |
| Ring structure and explanation of glucose.  |
| Ring structure and explanation of fructose, anomeric effects.   |

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Syllabus for the Academic Year 2014-15

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Thermodynamics:concepts of partial molar properties, graphical methods, intercept method and apparent molar volume method.   |
| Chemical potential with T&P Gibbs Duhem equation phase rule from the concept of chemical potential, thermodynamic properties of ideal solutions.   |
| Raoults law, Henrys law, non ideal systems, concept of fugacity, non ideal solutions, activities and activity coefficients.  |
| Determination activity coefficient from vapour pressure measurement, chemical equilibrium, effect temp on equilibrium constant, Vant hoff equation.                                      |
| Micelles and macro molecules: classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration.  |
| Factors affecting CMC, thermodynamics of micellization , phase separation and mass action models, solubilization, micro emulsions, reverse micelles.                                     |
| Polymers, types of polymers, electrically conducting polymer, liquid crystal polymers, kinetics of free radical polymerization, molecular mass number and mass average molecular weight. |
| Weight determination - end group analysis, osmometry, viscometry, light scattering methods.  |
| Chemical kinetics, collision theory, transition state theory Debye Huckel theory, salt effects.  |
| Hammett equation, Taft equation, consecutive reactions, parallel reactions, opposing reactions.  |
| Acid -base catalysis, Arrhenius diagram, fast reactions flow methods.  |
| Derivation of fluorescence and phosphorescence, quantum yields, quenching effect, Stern Volmer equation.   |
| Primary process, types of photochemical reactions, photodissociation, additional isomerisation reactions with examples.  |

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Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-II

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:II

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| NMR-Principle and Theory Introduction.  |
| Nature of spinning particle and its interaction with magnetic field.Chemical shift&origin spin-spin interaction,Application of NMR to structural elucidation.               |
| Electron spin resonance-principle and experimental technique –g-factor,Line shapes&Line widths hyperfine interactions.  |
| Applications of ESR studies.dimethylformamide,styrene   |
| Brief review on Entropy changes accompanying specific process-expansion,phase transition,heating measurement of Entropy.  |
| Nernst heat theorem,Third law of thermodynamics-Determination of the absolute entropy.  |
| Types of ensembles,thermodynamic probability,most probable distribution law –partition function,molar&molecular partitions.   |
| Rotational,translational,vibrational&electronic partition function –relation between thermodynamic function (E,H,S,G&Cv)and the partition.                                  |
| Electrochemistry-Electrochemical cell –Galvanic&Electrolytical cell.Concentration cell with&without transference,effect of complexation on redox potential.                 |
| Ferricyanide\ferrocyanide couple,Iron(III) .free radicals,metal complexes and biological systems.   |
| phenanthroline/Iron(II) phenanthroline couple.  |
| Determination of standard potential,solubility product equilibrium constant&activity coefficients from EMF data.  |
| Bjerrum theory of ion association concept of activity and activity coefficients in electrolytic solutions.  |
| The mean ionic activity coefficient,Debye-Huckel theory of electrolytic solutions,Limiting law.   |
| Calculation of mean ionic activity coefficient,limitations of Debye-Huckel theory.  |
| Effect of dilution on equivalent conductance of electrolytes,anomalous behavior of strong electrolyte.Debye-Huckel Onsagar equation-verification and limitations,fuel cell. |
| Electrochemistry-II the electrode-electrolyte interface.primary and secondary cells,batteries examples.   |
| The electric double layer.The Helmholtz-Perrin parallel-plate model,The Gouy-chapman diffuse-charge model&the stern.  |



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Department :P..G.ANALYTICAL CHEMISTRY  
 Class: II M.Sc.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-I  
 Semester:III

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| Classification different chromatographic methods, theory of chromatography, development techniques elution, gradient elution, displacement and frontal analysis |
| Chromatography phenomena migration, adsorption, partition adsorption coefficient retardation factor, retention time and volume.                                 |
| Partition isotherms, zone spreading, column capacity, temp effects, efficiency of chromatography column.  |
| HETP, Vandemeter equation resolution choice of column length, flow velocity, qualitative and quantitative analysis.   |
| Principle of column chromatography adsorption isotherms chromatographic media nature of forces between sample and stationary phase.                             |
| Column chromatography without detectors and liquid chromatography with detectors and application.   |
| Principles of gel exclusion chromatography properties of xerogels apparatus and detectors resolution.   |
| Principles of capillary electrophoresis, instrumentation applications to inorganic and organic compounds.   |
| Gas chromatography principle Instrumentation, columns detectors thermal conductivity, flame ionization electron capture,N-P detector.                           |
| Photo ionization, temp programming of G.C and applications structure of zeolites crystals types of sieves.  |
| Application in the separation of gases including hydrocarbons ion exclusion principles and applications.  |
| Affinity chromatography principle and applications, GC-MS Principle and instrumentation and applications of GC-MS   |
| Liquid-liquid partition chromatography principle, supports partition liquids, eluents, reverse phase chromatography apparatus applications, HPLC theory.        |
| HPL instrumentation, columns UV detector, RF detector, Fluorescence, diode array detector, .applications in the separation of organic compounds.                |
| Applications in the separation of organic compounds, names of other detectors used their principles and applications.   |
| LC-MS principle and instrumentation LC-MS data ion Chromatograms, selected ion monitoring. Processing LC-MS data, ion chromatograms,                            |
| Processing LC-MS data, ion chromatograms.   |

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Department :P.G.ANALYTICAL CHEMISTRY  
 Class:II M.Sc.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-II  
 Semester:IV

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| Paper chromatography principle, chromatographic medium, modified papers, solvent, systems mechanism of paper chromatography, experimental technique different development methods.   |
| Desending, horizontal circular spreading multiple development, two dimensional development, reverse phase chromatographic technique visualization chromatograms.   |
| Thin layer chromatography principle, media coating materials, applications simple development, solvent systems development of chromatoplate types of development of chromatoplate types of development visualization methods documentation applications in the separation HPTLC principle, technique applications. |
| Ion exchange chromatography principles systematic ion exchange resins properties of anion and cation exchange resin, ion exchange mechanism equilibria, selectivity, ion exchange capacity, applications of ion exchangers.  |
| In different fields, principles of ion exchange systems, equipment application specifically separations of lanthanides, actinides, amino acids , Ion chromatography principles of separation instrumentation, detectors.   |
| Separation of cations and anions applications in the analysis of water and air pollutants,. Basis of sampling, purpose of sampling homogenous and heterogeneous samples.   |
| Statistical criteria for good sampling sample size sampling unit, gross sample, Laboratory sample, sampling of solids, cone and quartering method.   |
| Long pile and alternative shovel method, precautions in preservation of solid samples, s   |
| sampling of metals and other solids rods wires, sheets, plates especially gold, silver, iron and other metals.   |
| Sampling of different types of liquids and techniques, sampling of drinking water industrial effluents. Precautions in sampling and preservation of collected liquids.   |
| Sampling of gases and preconcentration by adsorption or absorption method instantaneous monitoring, precautions.   |
| In preservation of samples, systematic sampling and random sampling importance of analytical chemistry   |
| To industrial research and development industries and other branches of science, development and validation of an analytical method.   |
| Units concentrations calculations, standards, chemical reactions, importance of separation methods with examples. principles and processes of solvent extraction, distribution law and partition coefficient, nature of partition forces.  |
| Different types of solvent extraction , solvent extraction systems, applications in metallurgy, general application in analysis and pre- concentration.  |
| Special extraction systems like crown ethers, super fluid and surfactant extractions- examples.  |

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Syllabus for the Academic Year 2014-15

Department:P.G.ANALYTICAL CHEMISTRY

Paper:QC&Traditional Methods of Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Classification of functional groups with suitable examples,Determination of functional groups imparting acidic nature-Thiol,Endiol.   |
| Determination of imparting acidic nature-Phenolic hydroxyl.Determination of imparting basic nature Aliphatic&Aromatic amines.Difference b\w Aliphatic and Aromatic Amines.                |
| Determination of Primary,Secondary,Tertialy Amines&Hydrize derivatives.   |
| Functional groups which imparting neither acidic nor basic nature-Aldehydes,Ketones,Nitro group,Methoxy,Olifinic group.   |
| Characterstics of an analysis-LOD,Sensitivity,Safty,Cost measurability,Selectivity&Specificity.   |
| Classification of errors,minimization of errors,ISO 9000 series,ISO 14000 series.   |
| Good labarotary practices&ICH guide lines on drug substances&products,control charts.   |
| Accuracy,precession,significant figures,normal distribustion,F-test   |
| Oxidant systems-Principles &Applications in Analysis-Inorganic systems Mn(III),Mn(VII),Ce(IV),Cr(VI)is determined.  |
| Determination of Inorganic systems V(v),Periodate,Iodate.Organic systems Chloramine-T.Oxidant properties and indicators.  |
| Organic compounds Principles of solubility of organic compounds,Non polar,Polar solvents.Recrystalliisation method and applications of solubility and recrystallisation.                  |
| Inorganic compounds definition of dissolution &decomposition.Principles of decomposition &dissolution,difference b\w Dissolution&decomposition. Decomposition with H <sub>2</sub> O,Hcl . |
| Decomposition with HF,HNO <sub>3</sub> ,H <sub>2</sub> SO <sub>4</sub> &HClO <sub>4</sub>   |
| Defination of fusion &Sintering.Difference b\w fusion & sintering &fusion with sintering with decomposition with examples.  |
| Decomposition techniques and parameters needs to be consider in the decomposing the samples for Analysis.   |
| Absorption of microwave energy and heating .Explain the ultrasonic resistered extraction.   |
| Statistical analysis –Mean deviation,standard deviation,coefficient of variance,T-test,Ruggedness test,Youden plot,Ranking test.  |
| Computations and propagation of errors representation of data,production and service elements of quality assurance,quality and quantity management system ,control tools.                 |

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Syllabus for the Academic Year 2014-15

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Traditional Methods of Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Precipitation methods-I:crystal habit &super saturation,nucleation and crystal growth,homogeneous&heterogeneous nucleation,solubility and particle size,colloids,completeness of precipitation                    |
| Effect of excess precipitant,ph,complex formation,temperature,purity of precipitates,aging.Co-precipitation & post precipitation:theory of adsorption of salts having an ion in common with the main precipitate. |
| Co-precipitation in colloidal precipitates,adsorption of solvents,mixed crystal formation by occlusion and entrapment,re-precipitation with examples,post-precipitation-theory of post-precipitation              |
| Examples of post precipitation,conditions for obtaining pure and quantitative precipitates.Precipitation titrations:principle,indicators for precipitation titrations,determination of halides.                   |
| Precipitation from homogeneous solution(PFHS):theory of PFHS,methods of PFHS-increase in pH,decrease in pH,cation release,anion release,reagent synthesis.  |
| Change in oxidation state,photochemical reactions,precipitation from mixed solvents,applications of PFHS methods.Gravimetric determinations:nature of species,preparation of solutions,limitations.               |
| Interferences,inorganic precipitants-chloride and sulphates,organic precipitants dimethyl glyoxime ,oxime,benzidine,salicyladoxime,benzoin oxime,sodium tetraphenyl boron,tetraphenyl arsonium chloride.          |
| Electro-gravimetric analysis:principle,important terms in electrogravimetry,decomposition voltage or decomposition potential,over voltage and their importance,instrumentation,electrolysis at constant current.  |
| Determination of Cu(II) by constant current electrolysis,electrolysis at controlled potentials,determination of Cu,Pb,Sn in brass and bronze by controlled potential electrolysis.                                |
| Reductant system-principles and applications in analysis:analytical chemistry of some selected reductant systems-formal.  |
| Standard and normal potential in various media,stability of the solutions,species responsible for the reduction properties.   |
| Standardisation,requirement for the selection of the reductants,selection of suitable indicators for various reductants systems.  |
| Inorganic systems-Cr(II),V(II),Ti(III),Sn(II),Fe(II) in H <sub>3</sub> PO <sub>4</sub> and hydrazine.   |
| Organic systems-hydroquinone and ascorbic acid,Analysis of some selected drugs:basic considerations of drugs-classification.  |
| Determination of the following drugs:acetyl salicylic acid,testosterone progesterone,cortisone  |
| Determination of sulphadiazine,phenobarbitone   |
| Determination of chloramphenicol,benzyl penicillin and tetracycline,thiamine,riboflavin,ascorbic acid.  |
| Determination of Isoniazid,metyldopa,metronidazole.   |

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Syllabus for the Academic Year 2014-15

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Intorduction of applied analysis, dissolution of complex materials various de chemical methods. Introduction of iron ore.  |
| Determiration of iron ore, determination manganese ore.  |
| Analysis of chromite ore and analysis of phosphate rock ore.   |
| Analysis of aluminium ore , analysis of finished product-1, analysis of steel.   |
| Analysis of blast furnance slag, analysis of refractory materials.   |
| Analysis of fluxes, analysis finished product-2, analysis of cement.   |
| Analysis of oils and analysis of soaps.  |
| Analysis of paints, introduction of water quality, standards for drinking water.   |
| Source of water, classification of water for different uses.   |
| Types of water pollutants and their affects, analytical methods, the determiration of anions like $\text{CO}_3^{-2}$ , $\text{HCO}_3^-$ , $\text{Cl}^-$ , $\text{F}^-$ |
| Analysis of anions $\text{SO}_4^{-2}$ , $\text{PO}_4^{-3}$ , $\text{NO}_3^-$ , $\text{NO}_2^-$ ,   |
| Determiration of anions is cynide, sulphide, determiration of cations like $\text{Fe}^{+2}$ , $\text{Fe}^{+3}$ $\text{Ca}^{+2}$ , $\text{Mg}^{+2}$ .                   |
| Determiration of cations $\text{Cr}^{+3}$ , $\text{As}^{+5}$ .   |
| Determiration of cations $\text{Pb}^{+2}$ , $\text{Hg}^{+2}$ , $\text{Cu}^{+2}$ .  |
| Determiration of cations $\text{Zn}^{+2}$ , $\text{Cd}^{+2}$ , $\text{Co}^{+2}$ .  |
| Determiration of D.O,B.O.D,C.O.D.  |
| Standards for drinking water, general introduction, uses and application of water quality.   |
| Saponification number,iodine number,acid number,diffirent uses for the assessment of water quality   |

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Syllabus for the Academic Year 2014-15

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Introduction of analysis of raw materials,analysis of non-ferrous alloys,analysis of ferro alloys   |
| Analysis of brass,analysis of bronze,analysis of solder   |
| Analysis of ferro silicon constituents are si,c,p,s;analysis of ferro vanadium constituents are v,c,p,s,si,Al   |
| Analysis of ferro manganese,analysis of silico manganese  |
| Introduction of analysis of soils,fertilizers and fuel  |
| Analysis of soils:sampling,determination of moisture,total N,P,Si,lime,humus nitrogen,alkali salts,soil absorption ratio.   |
| Analysis of fertilizer:ammonical fertilizers,phosphate fertilizes,nitrate fertilizers   |
| Analysis of fuels:sold fuels-coal,proximate analysis,ultimate analysis,heating value,grading of coal based on ultimate heat value {UHV}   |
| Assessment oair quality:composition opure air,classification of air pollutants,toxic elements presents in dust and their sources  |
| Collection of air samples,sources,effects,control of pollution and chemical analysis for the following  |
| Primary pollutants:corbon compounds-(CO),carbon dioxide,sulphur compounds:sulphur dioxide,sulphur trioxide,hydrogen sulphide  |
| Nitrogen compounds:nitric oxide,nitrogen dioxide,hydrocarbons:-aliphatic hydrocarbons&polycyclic aromatic hydrocarbons  |
| Particulate matter-repairable&suspended particulate matter,inorganic&organic particulates   |
| Secondary pollutants-ozone,peroxy acetyl nitrate,peroxy benzyl nitrate;standards for amient air quality   |
| Kinetic methods of analysis:introduction,slow reactions,catalyzed reactions   |
| Methods of determination of catalyst concentration,extrapolation methods for the determination of catalyst,variable time method,fixed time method   |
| Examples for the determination of toxic metals and anions using some typical kinetic reactions.Non aqueous titrimetry:classification of solvents and titrations for non aqueous titrymetry. |
| Types of reactions-indicators:determination of acids,determination of bases,karl-fisher reagent for the determination of moisture content in drugs and other samples                        |

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Syllabus for the Academic Year 2014-15

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-I

Class:II M.Sc. ANALYTICAL CHEMISTRY

Semester:III

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| Laws of absorption, deviations from beer's law, single and double beam, spectrometers.  |
| Instrumentation , sources of radiation detectors qualitative analysis by absorption measurements , general precautions in colorimetric determination,.  |
| Spectro photometric titrations, principle of diode array detector determination of $\text{Fe}^{+2}$ , and $\text{Fe}^{+3}$ .  |
| Determination of $\text{Al}^{+3}$ , $\text{NH}_4^+$ , $\text{Cr}^{+3}$ , $\text{Cr}^{+6}$ , $\text{Co}^{+3}$ , $\text{Cu}^{+2}$ , $\text{Ni}^{+2}$ , $\text{NO}_2^-$ , $\text{PO}_4^{-3}$ , Simultaneous determination of $\text{KMnO}_4$ and $\text{K}_2\text{Cr}_2\text{O}_7$ . Theory of fluorescence and phosphorescence, factors affecting these two, principle and instrumentation of Spectrofluorimetry. |
| Units of frequency, wavelength, and wave number, molecular vibrations factors influencing frequencies, instrumentation of IR spectroscopy.  |
| Sampling techniques detectors in IR, qualitative and quantitative analysis with reference to selected molecules like CO and $\text{CO}_2$ .   |
| Non destructive IR method for the analysis of CO and other organic compounds, principle of FT-IR.   |
| Theory of Raman spectroscopy and instrumentation and Raman spectra of CO, $\text{CO}_2$ , $\text{N}_2\text{O}$ and $\text{H}_2\text{O}$ , Differences between Raman spectra and IR spectra.   |
| Resonance condition, Origin of NMR spectra, factors affecting chemical shift, shielding and de shielding.   |
| Spin-spin coupling, interpretation of NMR spectra of organic compounds factors influencing NMR spectra Fast chemical reactions  |
| Magnitude of I, nuclei with Quadrapole moments FT-NMR Study of isotopes other than proton $^{13}\text{C}$ $^{15}\text{N}$ , $^{19}\text{F}$ , $^{31}\text{P}$ , $^{11}\text{B}$ double resonance, shift reagents, Spin tickling and applications.   |
| Theory of ESR and instrumentation , g-value, hyperfine splitting qualitative analysis, Kramer's degeneracy.   |
| Instrumentation of ESR differences between ESR and NMR spectra. Qualitative analysis, study of free radicals and other applications.  |
| Mass spectroscopy principle and ion sources, inlets, detectors.   |
| Types of peaks, observed resolution qualitative analysis molecular weight determination   |
| Quantitative analysis, advantages chemical analysis of X-RF matrix effects, advantages of X-RF wave length, dispersive technique and evaluation methods.  |
| X-RF energy dispersive technique and evaluation method, applications.   |
| Instrumentation of X-RF, matrix effects, and its advantages.  |

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Syllabus for the Academic Year 2014-15

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-II

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:IV

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| Flame photometry theory, instrumentation combustion flames, detectors, and analysis of Na, K ,Ca and Mg, atomic absorption spectrometer theory and instrumentation, flame techniques.  |
| Resonance line sources, hollow cathode lamp chemical and spectral interferences. applications with special reference to analysis of trace metal in oils, allows and toxic metals in drinking water and effluents.  |
| ICP-AES, ICP-MS principles, instrumentation of plasma, AES detectors, quadra-pole mass spectrometers, differences between the two detectors.   |
| Applications of liquids and solids, applications in the analysis of trace and toxic metals in water geological and industrial samples, arc and spark spectrographic direct analysis of solid for metals.   |
| Thermo Gravimetry theory, instrumentation and applications, with special reference to $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , $\text{CaCO}_3$ , $(\text{COOH})_2$ . differential thermal analysis- principle, instrumentation, difference between TG and DTA. |
| DTA-applications with special reference to the clays and minerals coals (fuels), differential scanning calorimetry - principle, instrumentation and applications to inorganic materials like chlorates and perchlorates  |
| Determination of ammonium nitrate organic compound and drugs by using DSC. Principle of Polarography, , residual current, migration current ,diffusion current, half wave potential ILKOVIC equation and DME instrumentation.  |
| Advantages & disadvantages, qualitative and quantitative analysis of inorganic ions Cu, Bi , Pb,Cd and Zn. AC polarography, pulse polarography   |
| Principle, instrumentation of HMDE application in the analysis of Pb and Cd in environmental samples.  |
| Principle of cathode stripping voltametry principles of coulometric analysis with constant current coulometric analysis of cations- As(III),Fe(II).  |
| Determination $\text{I}^-$ and $\text{S}^{2-}$ by using $\text{I}_2$ liberations and $\text{Ce}^{+4}$ liberation in solutions coulometric analysis with controlled potentials.   |
| Reference electrodes- hydrogen electrode calomel electrode, silver chloride.   |
| Indicator electrodes- hydrogen electrode, glass electrodes, theory of membrane potentials and glass electrodes, theory of membrane potentials and liquid junction potentials, calibration of ion selective electrodes.   |
| Ion selective electrodes with fixed membrane sited Ag, Pb, Cd, S, F, CN and glass electrodes applications in the analysis of air and water.  |
| Detection and measurements of radio activity introduction to radioactive traces applications of tracer technique.  |
| Isotope dilution analysis applications activation analysis applications advantages disadvantages radio carbon dating technique.  |



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Bhimavaram, W.G.Dist, A.P

Syllabus for the Academic Year 2013-14

Department:P.G.ANALYTICAL CHEMISTRY

Paper: GENERAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Wave equation-interpretation of wave function-properties of wave function-Normalisation and orthogonalisation  |
| Operators-Linear and Non linear ,Commutators of Operators  |
| Postulates of Quantum mechanics,Setting up of operators obserbables  |
| Hermitian operator-Eigen values of hermitian operator  |
| Basic quantum chemistry-II; Wave mechanics of simple systems with constant potential energy ,partical in one dimensional box .   |
| Factors influencing color transition –dipole integral , symmetry arguments in deriving the selection rules.  |
| Wave mechanics of systems with variable potential energy –symple harmonic oscillator , solution of wave equation-selection rules.  |
| calculation of bond length –isotopic effect,second order stark effect and its applications   |
| Molecular spectroscopy-I;Rotational spectra of diatomic molecules-Rigid rotor Selection rules-calculation of bond length –isotopic effect,second order stark effect and its applications |
| Infrared spectra of diatomic molecules , harmonic and anharmonic oscillators –selection rules.   |
| Overtone combination bands – calculation of force constant , anharmonicity constant and zero point energy.   |
| Fermi resonance ,simultaneous vibration-rotation spectra of diatomic molecule .  |
| Molecular spectroscopyII-Raman effect –classical and quantum mechanical explanations   |
| Franck Condon principle –applications ,Rotational fine structure . Charge transfer spectra-band head and band shading  |

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Syllabus for the Academic Year 2013-14

Department : P.G.ANALYTICAL CHEMISTRY

Paper :GENERAL CHEMISTRY

Class: I M.SC ANALYTICAL CHEMISTRY

Semester:II

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|---|
| Basic Quantum chemistry III-Hydrogen atom ,probability density in orbitals ,shapes of orbitals .  |
| Perturbation theory- line independent perturbation theory Only first order perturbation is to be dealt with   |
| Application to ground state energy of Helium atom . Variation principle –Application –Calculation   |
| Symmetry operations and point groups, classification of molecules in to point groups.   |
| Group theory – group multiplication table for C <sub>2v</sub> and C <sub>3v</sub> point groups.   |
| Representations, reducible and irreducible representations, Mulliken symbols, orthogonality theorem and its implications                              |
| Treatment of analytical data, classification of errors, determinations of indeterminate errors, minimisation of errors- absolute and relative errors, |
| Standard deviations- standard error of mean – student' t-test, testing for significance – comparison of two means – f –tes.                           |
| Basic quantum chemistry -4; Valence bond approach –directed valence hybridization .   |
| Calculation of ionic and covalent bond contribution in hydrogen molecule  |
| Molecular orbital theory- LCAO approximation –hydrogen molecule ion   |
| Hydrogen molecule (fundamental concepts only) –The electronic transition in the hydrogen molecule .   |
| Computer languages operating systems – principles of algorithms and flow charts.  |
| Arithmetic expressions – arithmetic statements- replacement statements – IF statements.   |
| Logical IF and block IF statements – GOTO statements, subscripted, variable and DIMENSION statement   |
| DO statement – rules for DO statements, functions and subroutines-development of FORTRAN statements for simple formula in chemistry.                  |
| Nernst equation, pH of solution – first order rate equation – cell constant – electrode potential.  |

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Syllabus for the Academic Year 2013-14

**Department:P.G. ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-I**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:I**

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| Structure & Bonding:Application of VSEPR , Valence bond theory and applications.  |
| Molecular orbital theories,Structure of Simple molecules.   |
| Applications of MO theory to Square planar &Octahedral complexes.   |
| Walsh diagram for water molecule.   |
| Coordination compounds;Crystal field theory- Crystal field splitting patterns in octahedral,tetrahedral,tetragonal ,square planar,trigonal bipyramidal geometries.                  |
| Calculations of CFSE, Factors affecting crystal field splitting energies ,spectrochemical series .  |
| Jahn-Teller effect, Nephelauxetic effect, ligand field theory .   |
| Term symbols –Russell sanders coupling, derivation of term symbols for various configurations .Spectroscopic ground states.   |
| Inorganic cage and ring compounds; Preparation ,structure and reactions of boranes , carboranes.  |
| Preparation , structure and reactions of metallocarboranes ,boron-nitrogen cyclic compounds .   |
| Phosphorus-nitrogen and sulphur- nitrogen cyclic compounds .  |
| Electron counting in boranes –Wades rules.Isopoly and Heteropoly acids.   |
| Electronic spectra of transition metal complexes;Selection rules ,break down of selection rules Orgel diagrams,T-S diagrams for $d^1$ - $d^9$ Octahedral and tetrahedral complexes. |
| Charge transfer spectra , Quenching of orbital momentum .   |

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Syllabus for the Academic Year 2013-14

**Department:P.G.ANALYTICAL CHEMISTRY**

**Paper: INORGANIC CHEMISTRY-II**

**Class: I M.Sc ANALYTICAL CHEMISTRY**

**Semester:II**

|   |
|---|
| Metal cluster compounds –Definition –evidences for existence of M-M bonds conditions favourable for formation of M-M bonds  |
| Classification of binuclear cluster compounds ,Confacial bioctahedron structures  |
| Trinuclear cluster compounds and polynuclear cluster compounds  |
| Polyatomic clusters –Zintl ions,chevreton phases.   |
| Organo metallic compounds :16 and18 electrons rules, isolobal relationship  |
| Iso electron relationship- synthesis structure and bonding of carbonmonoxide dinitrogen and nitricoxide complexes.  |
| Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.  |
| Classification metal carbonyls.   |
| Metal ligand equilibrium in solution: step wise and overall formation constants, factors effecting the stability metal complexes.                                     |
| Pearsons theory of hard and soft acids and bases, chelate effect, determination of stability constant.  |
| Inert and labile complexes, explanation of lability on the basis of VBT and CFT.biological and abiological nitrogen fixation.   |
| Metallo porphyrins with special reference to haemoglobin and myoglobin, biological role of alkali and alkaline earth metal ions with special reference to $Ca^{+2}$ . |
| In organic reaction mechanisms:ligand replacement reactions of metal complexes, acid hydrolysis- factors effecting acid hydrolysis.                                   |
| Anation and base hydrolysis of cobalt (III)complexes, ligand displacement reactions of square planar complexes of Pt(II).   |
| Factors effecting square planar substitutions – trans effect, complementary and non complementary reactions with examples.  |
| Electron transfer reactions of complexes- inner and outer sphere mechanisms.  |

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Syllabus for the Academic Year 2013-14

Department :P.G.ANALYTICAL CHEMISTSRY

Paper :ORGANIC CHEMISTRY-I

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:I

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| Localised and delocalised covalent bond, concept of resonance, aromaticity, Huckle's rule.  |
| Benzenoid and non benzenoid compounds, anto aromaticity, homo aromaticity, nature of reaction energy and kinetic considerations.  |
| Types of organic reactions, reagents, reactive intermediates, formation and stabilization, inductive and mesomeric effects.   |
| Stereo chemistry conformational isomerism, acyclic and simple systems, substituted ethanes.   |
| Cyclo pentane, cyclo hexane, cyclo heptanes, cyclo octane and decalins.   |
| Optical isomerism, optical activity, molecular dissymmetry and chirality, elements of symmetry.   |
| Fisher's projection, D,L and R,S configurations, relative absolute configurations, optical isomerism due to asymmetric carbon atoms, bi phenyls allenes, spirans, racemisation, resolution. |
| Geometrical isomerism, E,Z configurations, properties.  |
| Hetero cyclic compounds, synthesis and reactivity of pyridine, quinoline, iso quinoline.  |
| Indole, benzo furan, benzo thiofene, pyrazole.  |
| Imidazole, oxazole, isoxazole, thiazole, isothiazole, pyridazine, pyrimidine, pyrazine  |
| Chemistry of some typical natural products, isolation, structure, elucidation, synthesis and bio genesis of the following compounds,flavonoids.   |
| Quercetin, cyanidin, genestein, terpenoids.   |
| Alpha terpenol, alpha pinene, camphor, farnesol.  |

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Syllabus for the Academic Year 2013-14

Department :P.G.ANALYTICAL CHEMISTSRY

Paper :ORGANIC CHEMISTRY-II

Class: I M.Sc ANALYTICAL CHEMISTRY

Semester:II

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| Aromatic substitution reactions, electrophilic, nucleophilic and through benzyne, radical substitution of arenes.  |
| Orientation of nucleophilic substitution at saturated carbon, SN1, SN2.  |
| SNi reactions, effect of structure, nucleophile, leaving group, solvent, addition, involving, electrophiles, nucleophiles and free radicals.             |
| Elimination reactions, E1, E1CB, E2 reactions, elimination versus substitution reactions.  |
| Mechanism of some named reactions, Aldol, Perkin, Benzoin, Cannizzaro reactions  |
| Wittig, Grignard, Reformatsky, Meerwein, Hoffmann, Claisen rearrangements.   |
| Favorsky rearrangement, hydroboration, openauer oxidation, Clemmensen reduction, Meerwein-Ponndorf and Verley, Birch reduction, Stork enamine reactions. |
| Michael addition, Mannich reaction, Diel's -Alder reaction, Ene reaction, Bayer-Villiger reaction,   |
| Spectra and structure, application of organic spectroscopy, UV Spectroscopy.   |
| IR spectroscopy, basic principles and importance.  |
| PMR spectroscopy, basic principles and importance.   |
| Mass spectroscopy, basic principle and importance.   |
| Isolation, structure, elucidation and synthesis of alkaloids, atropine, nicotine, quinine.   |
| Purines, caffeine, configuration.  |
| Ring structure and explanation of glucose.   |
| Ring structure and explanation of fructose, anomeric effects.  |

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Syllabus for the Academic Year 2013-14

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-I

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:I

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| Thermodynamics:concepts of partial molar properties, graphical methods, intercept method and apparent molar volume method.   |
| Chemical potential with T&P Gibbs Duhem equation phase rule from the concept of chemical potential, thermodynamic properties of ideal solutions.   |
| Raoults law, Henrys law, non ideal systems, concept of fugacity, non ideal solutions, activities and activity coefficients.  |
| Determination activity coefficient from vapour pressure measurement, chemical equilibrium, effect temp on equilibrium constant, Vant hoff equation.                                      |
| Micelles and macro molecules: classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration.  |
| Factors affecting CMC, thermodynamics of micellization , phase separation and mass action models, solubilization, micro emulsions, reverse micelles.                                     |
| Polymers, types of polymers, electrically conducting polymer, liquid crystal polymers, kinetics of free radical polymerization, molecular mass number and mass average molecular weight. |
| Weight determination - end group analysis, osmometry, viscometry, light scattering methods.  |
| Chemical kinetics, collision theory, transition state theory Debye Huckel theory, salt effects.  |
| Hammett equation, Taft equation, consecutive reactions, parallel reactions, opposing reactions.  |
| Acid -base catalysis, Arrhenius diagram, fast reactions flow methods.  |
| Photochemistry: Franck Condon principle, excited molecules, singlet and triplet states, spin orbit interactions, actinometry, ferrioxalate and uranyl oxalate actinometers - problems.   |
| Derivation of fluorescence and phosphorescence, quantum yields, quenching effect, Stern Volmer equation.   |
| Primary process, types of photochemical reactions, photodissociation, additional isomerisation reactions with examples.  |

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Syllabus for the Academic Year 2013-14

Department:P.G.ANALYTICAL CHEMISTRY

Paper: PHYSICAL CHEMISTRY-II

Class: I MSc.ANALYTICAL CHEMISTRY

Semester:II

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|---|
| NMR-Principle and Theory Introduction.  |
| Nature of spinning particle and its interaction with magnetic field.Chemical shift&origin spin-spin interaction,Application of NMR to structural elucidation.               |
| Electron spin resonance-principle and experimental technique –g-factor,Line shapes&Line widths hyperfine interactions.  |
| Applications of ESR studies.dimethylformamide,styrene.  |
| Brief review on Entropy changes accompanying specific process-expansion,phase transition,heating measurement of Entropy.  |
| Nernst heat theorem,Third law of thermodynamics-Determination absolute  |
| Types of ensembles,thermodynamic probability,most probable distribution law –partition function,molar&molecular partitions.   |
| Rotational,translational,vibrational&electronic partition function –relation between thermodynamic function (E,H,S,G&Cv)and the partition functions.                        |
| Electrochemistry-Electrochemical cell –Galvanic&Electrolytical cell.Concentration cell with&without transference,effect of complexation on redox potential.                 |
| Ferricyanide\ferrocyanide couple,Iron(III) .free radicals,metal complexes and biological systems.   |
| phenanthroline/Iron(II) phenanthroline couple.  |
| Determination of standard potential,solubility product equilibrium constant&activity coefficients from EMF data.  |
| Bjerrum theory of ion association concept of activity and activity coefficients in electrolytic solutions.  |
| The mean ionic activity coefficient,Debye-Huckel theory of electrolytic solutions,Limiting law.   |
| Calculation of mean ionic activity coefficient,limitations -  |
| Effect of dilution on equivalent conductance of electrolytes,anomalous behavior of strong electrolyte.Debye-Huckel Onsagar equation-verification and limitations,fuel cell. |
| Electrochemistry-II the electrode-electrolyte interface.primary and secondary cells,batteries examples.   |
| The electric double layer.The Helmholtz-Perrin parallel-plate model,The Gouy-chapman diffuse-charge model&the stern   |



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 Syllabus for the Academic Year 2013-14

Department :P..G.ANALYTICAL CHEMISTRY  
 Class: II M.Sc.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-I  
 Semester:III

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| Classification different chromatographic methods, theory of chromatography, development techniques elution, gradient elution, displacement and frontal analysis. Chromatography phenomena migration, adsorption, partition adsorption coefficient retardation factor, retention time and volume. |
| Principle of column chromatography adsorption isotherms chromatographic media nature of forces between sample and stationary phase.  |
| Column chromatography without detectors and liquid chromatography with detectors and application.  |
| Principles of gel exclusion chromatography properties of xerogels apparatus and detectors resolution. Principles of capillary electrophoresis, instrumentation applications to inorganic and organic compounds.  |
| Gas chromatography principle Instrumentation, columns detectors thermal conductivity, flame ionization electron capture,N-P detector.  |
| Photo ionization, temp programming of G.C and applications structure of zeolites crystals types of sieves.   |
| Application in the separation of gases including hydrocarbons ion exclusion principles and applications.   |
| Affinity chromatography principle and applications, GC-MS Principle and instrumentation and applications of GC-MS  |
| Liquid-liquid partition chromatography principle, supports partition liquids, eluents, reverse phase chromatography apparatus applications, HPLC theory.   |
| HPL instrumentation, columns UV detector, RF detector, Fluorescence, diode array detector, .applications in the separation of organic compounds.   |
| Applications in the separation of organic compounds, names of other detectors used their principles and applications.  |
| LC-MS principle and instrumentation LC-MS data ion Chromatograms, selected ion monitoring.   |
| Processing LC-MS data, ion chromatograms, Processing LC-MS data, ion chromatograms.  |
| Library searching quantitative measurements Applications of LC-MS for Drug analysis, Environmental Samples and others.   |

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 Syllabus for the Academic Year 2013-14

Department :P..G.ANALYTICAL CHEMISTRY  
 Class: II M.Sc.ANALYTICAL CHEMISTRY

Paper :SEPARATION METHODS-II  
 Semester:IV

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| Paper chromatography principle, chromatographic medium, modified papers, solvent, systems mechanism of paper chromatography, experimental technique different development methods.   |
| Desending, horizontal circular spreading multiple development, two dimensional development, reverse phase chromatographic technique visualization chromatograms.   |
| Thin layer chromatography principle, media coating materials, applications simple development, solvent systems development of chromatoplate types of development of chromatoplate types of development visualization methods documentation applications in the separation HPTLC principle, technique applications. |
| Ion exchange chromatography principles systematic ion exchange resins properties of anion and cation exchange resin, ion exchange mechanism equilibria, selectivity, ion exchange capacity, applications of ion exchangers.  |
| In different fields, principles of ion exchange systems, equipment application specifically separations of lanthanides, actinides, amino acids , Ion chromatography principles of separation instrumentation, detectors.   |
| Separation of cations and anions applications in the analysis of water and air pollutants,. Basis of sampling, purpose of sampling homogenous and heterogeneous samples.   |
| Statistical criteria for good sampling sample size sampling unit, gross sample, Laboratory sample, sampling of solids, cone and quartering method.   |
| Long pile and alternative shovel method, precautions in preservation of solid samples.   |
| sampling of metals and other solids rods wires, sheets, plates especially gold, silver, iron and other metals.   |
| Sampling of different types of liquids and techniques, sampling of drinking water industrial effluents. Precautions in sampling and preservation of collected liquids.   |
| Sampling of gases and preconcentration by adsorption or absorption method instantaneous monitoring, precautions.   |
| In preservation of samples, systematic sampling and random sampling importance of analytical chemistry   |
| To industrial research and development industries and other branches of science, development and validation of an analytical method.   |
| Units concentrations calculations, standards, chemical reactions, importance of separation methods with examples. principles and processes of solvent extraction, distribution law and partition coefficient, nature of partition forces.  |
| Different types of solvent extraction , solvent extraction systems, applications in metallurgy, general application in analysis and pre- concentration.  |
| Special extraction systems like crown ethers, super fluid and surfactant extractions- examples.  |

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Syllabus for the Academic Year 2013-14

Department:P.G.ANALYTICAL CHEMISTRY

Paper:QC&Traditional Methods of Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Classification of functional groups with suitable examples,Determination of functional groups imparting acidic nature-Thiol,Endiol.   |
| Determination of imparting acidic nature-Phenolic hydroxyl.Determination of imparting basic nature Aliphatic&Aromatic amines.Difference b\w Aliphatic and Aromatic Amines.                |
| Determination of Primary,Secondary,Tertialy Amines&Hydrize derivatives.   |
| Functional groups which imparting neither acidic nor basic nature-Aldehydes,Ketones,Nitro group,Methoxy,Olifinic group.   |
| Characterstics of an analysis-LOD,Sensitivity,Safty,Cost measurability,Selectivity&Specificity.   |
| Classification of errors,minimization of errors,ISO 9000 series,ISO 14000 series.   |
| Good labarotary practices&ICH guide lines on drug substances&products,control charts.   |
| Accuracy,precession,significant figures,normal distribustion,F-test   |
| Oxidant systems-Principles &Applications in Analysis-Inorganic systems Mn(III),Mn(VII),Ce(IV),Cr(VI)is determined.  |
| Determination of Inorganic systems V(v),Periodate,Iodate.Organic systems Chloramine-T.Oxidant properties and indicators.  |
| Organic compounds Principles of solubility of organic compounds,Non polar,Polar solvents.Recrystalliisation method and applications of solubility and recrystallisation.                  |
| Inorganic compounds definition of dissolution &decomposition.Principles of decomposition &dissolution,difference b\w Dissolution&decomposition. Decomposition with H <sub>2</sub> O,Hcl . |
| Decomposition with HF,HNO <sub>3</sub> ,H <sub>2</sub> SO <sub>4</sub> &HClO <sub>4</sub>   |
| Defination of fusion &Sintering.Difference b\w fusion & sintering &fusion with sintering with decomposion with examples.  |
| Decomposition techniques and parameters needs to be consider in the decomposing the samples for Analysis.   |
| Absorption of microwave energy and heating .Explain the ultrasonic resistered extraction.   |
| Statistical analysis –Mean deviation,standard deviation,coefficient of variance,T-test,Ruggedness test,Youden plot,Ranking test.  |
| Computations and propagation of errors representation of data,production and service elements of quality assurance,quality and quantity management system ,control tools.                 |

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Syllabus for the Academic Year 2013-14

Department:P.G. ANALYTICAL CHEMISTRY

Paper:Traditional Methods of Analysis-II Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Precipitation methods-I:crystal habit &super saturation,nucleation and crystal growth,homogeneous&heterogeneous nucleation,solubility and particle size,colloids,completeness of precipitation                    |
| Effect of excess precipitant,ph,complex formation,temperature,purity of precipitates,aging.Co-precipitation & post precipitation:theory of adsorption of salts having an ion in common with the main precipitate. |
| Co-precipitation in colloidal precipitates,adsorption of solvents,mixed crystal formation by occlusion and entrapment,re-precipitation with examples,post-precipitation-theory of post-precipitation              |
| Examples of post precipitation,conditions for obtaining pure and quantitative precipitates.Precipitation titrations:principle,indicators for precipitation titrations,determination of halides.                   |
| Precipitation from homogeneous solution(PFHS):theory of PFHS,methods of PFHS-increase in pH,decrease in pH,cation release,anion release,reagent synthesis.  |
| Change in oxidation state,photochemical reactions,precipitation from mixed solvents,applications of PFHS methods.Gravimetric determinations:nature of species,preparation of solutions,limitations.               |
| Interferences,inorganic precipitants-chloride and sulphates,organic precipitants dimethyl glyoxime ,oxime,benzidine,salicyladoxime,benzoin oxime,sodium tetraphenyl boron,tetraphenyl arsonium chloride.          |
| Electro-gravimetric analysis:principle,important terms in electrogravimetry,decomposition voltage or decomposition potential,over voltage and their importance,instrumentation,electrolysis at constant current.  |
| Determination of Cu(II) by constant current electrolysis,electrolysis at controlled potentials,determination of Cu,Pb,Sn in brass and bronze by controlled potential electrolysis.                                |
| Reductant system-principles and applications in analysis:analytical chemistry of some selected reductant systems-formal.  |
| Standard and normal potential in various media,stability of the solutions,species responsible for the reduction properties.   |
| Standardisation,requirement for the selection of the reductants,selection of suitable indicators for various reductants systems.  |
| Inorganic systems-Cr(II),V(II),Ti(III),Sn(II),Fe(II) in H <sub>3</sub> PO <sub>4</sub> and hydrazine.   |
| Organic systems-hydroquinone and ascorbic acid,Analysis of some selected drugs:basic considerations of drugs-classification.  |
| Determination of the following drugs:acetyl salicylic acid,testosterone progesterone,cortisone  |
| Determination of sulphadiazine,phenobarbitone   |
| Determination of chloramphenicol,benzyl penicillin and tetracycline,thiamine,riboflavin,ascorbic acid.  |
| Determination of Isoniazid,metyldopa,metronidazole.   |

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Syllabus for the Academic Year 2013-14

Department:P.G.ANALYTICAL CHEMISTRY

Paper:Applied Analysis-I

Class:II M.Sc.Analytical Chemistry

Semester:III

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| Intorduction of applied analysis, dissolution of complex materials various de chemical methods.<br>Introduction of iron ore.   |
| Determiration of iron ore, determination manganese ore.  |
| Analysis of chromite ore and analysis of phosphate rock ore.   |
| Analysis of aluminium ore , analysis of finished product-1, analysis of steel.   |
| Analysis of blast furnance slag, analysis of refractory materials.   |
| Analysis of fluxes, analysis finished product-2, analysis of cement.   |
| Analysis of oils and analysis of soaps.  |
| Analysis of paints, introduction of water quality, standards for drinking water.   |
| Source of water, classification of water for different uses.   |
| Types of water pollutants and their affects, analytical methods, the determiration of anions like $\text{CO}_3^{-2}$ , $\text{HCO}_3^-$ , $\text{Cl}^-$ , $\text{F}^-$ |
| Analysis of anions $\text{SO}_4^{-2}$ , $\text{PO}_4^{-3}$ , $\text{NO}_3^-$ , $\text{NO}_2^-$ ,   |
| Determiration of anions is cynide, sulphide, determiration of cations like $\text{Fe}^{+2}$ , $\text{Fe}^{+3}$ $\text{Ca}^{+2}$ , $\text{Mg}^{+2}$ .                   |
| Determiration of cations $\text{Cr}^{+3}$ , $\text{As}^{+5}$ .   |
| Determiration of cations $\text{Pb}^{+2}$ , $\text{Hg}^{+2}$ , $\text{Cu}^{+2}$ .  |
| Determiration of cations $\text{Zn}^{+2}$ , $\text{Cd}^{+2}$ , $\text{Co}^{+2}$ .  |
| Determiration of D.O,B.O.D,C.O.D.  |
| Standards for drinking water, general introduction, uses and application of water quality.   |
| Saponification number,iodine number,acid number,diffirent uses for the assessment of water quality   |

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Syllabus for the Academic Year 2013-14

Department:P.G. ANALYTICAL CHEMISTRY

Paper:Applied Analysis-II

Class:II M.Sc.Analytical Chemistry

Semester:IV

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| Introduction of analysis of raw materials,analysis of non-ferrous alloys,analysis of ferro alloys   |
| Analysis of brass,analysis of bronze,analysis of solder   |
| Analysis of ferro silicon constituents are si,c,p,s;analysis of ferro vanadium constituents are v,c,p,s,si,Al   |
| Analysis of ferro manganese,analysis of silico manganese  |
| Introduction of analysis of soils,fertilizers and fuel  |
| Analysis of soils:sampling,determination of moisture,total N,P,Si,lime,humus nitrogen,alkali salts,soil absorption ratio.   |
| Analysis of fertilizer:ammonical fertilizers,phosphate fertilizes,nitrate fertilizers   |
| Analysis of fuels:sold fuels-coal,proximate analysis,ultimate analysis,heating value,grading of coil based on ultimate heat value{UHV}  |
| Assessment oair quality:composition opure air,classification of air pollutants,toxic elements presents in dust and their sources  |
| Collection of air samples,sources,effects,control of pollution and chemical analysis for the following  |
| Primary pollutants:corbon compounds-(CO),carbon dioxide,sulphur compounds:sulphur dioxide,sulphur trioxide,hydrogen sulphide  |
| Nitrogen compounds:nitric oxide,nitrogen dioxide,hydrocarbons:-aliphatic hydrocarbons&polycyclic aromatic hydrocarbons  |
| Particulate matter-repairable&suspended particulate matter,inorganic&organic particulates   |
| Secondary pollutants-ozone,peroxy acetyl nitrate,peroxy benzyl nitrate;standards for amient air quality   |
| Kinetic methods of analysis:introduction,slow reactions,catalyzed reactions   |
| Methods of determination of catalyst concentration,extrapolation methods for the determination of catalyst,variable time method,fixed time method   |
| Examples for the determination of toxic metals and anions using some typical kinetic reactions.Non aqueous titrimetry:classification of solvents and titrations for non aqueous titrymetry. |
| Types of reactions-indicators:determination of acids,determination of bases,karl-fisher reagent for the determination of moisture content in drugs and other samples                        |

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(A College with Potential for Excellence)

Bhimavaram, W.G.Dist, A.P

Syllabus for the Academic Year 2013-14

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-I

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:III

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| Laws of absorption, deviations from beer's law, single and double beam, spectrometers. qualitative analysis by absorption measurements , general precautions in colorimetric determination,  |
| Spectro photometric titrations, principle of diode array detector determination of $Fe^{+2}$ , and $Fe^{+3}$ .   |
| Determination of $Al^{+3}$ , $NH_4^+$ , $Cr^{+3}$ , $Cr^{+6}$ , $Co^{+3}$ , $Cu^{+2}$ , $Ni^{+2}$ , $NO_2^-$ , $PO_4^{-3}$ , Simultaneous determination of $KMnO_4$ and $K_2Cr_2O_7$ . Theory of fluorescence and phosphorescence, factors affecting these two, principle and instrumentation of Spectrofluorimetry. |
| Units of frequency, wavelength, and wave number, molecular vibrations factors influencing frequencies, instrumentation of IR spectroscopy. qualitative and quantitative analysis with reference to selected molecules like CO and CO   |
| Non destructive IR method for the analysis of CO and other organic compounds, principle of FT-IR.  |
| Theory of Raman spectroscopy and instrumentation and Raman spectra of CO, CO <sub>2</sub> , N <sub>2</sub> O and H <sub>2</sub> O, Differences between Raman spectra and IR spectra.   |
| Resonance condition, Origin of NMR spectra, factors affecting chemical shift, shielding and deshielding.   |
| Spin-spin coupling, interpretation of NMR spectra of organic compounds factors influencing NMR spectra Fast chemical reactions   |
| Magnitude of I, nuclei with Quadrapole moments FT-NMR Study of isotopes other than proton <sup>13</sup> C <sup>15</sup> N, <sup>19</sup> F, <sup>31</sup> P, <sup>11</sup> B double resonance, shift reagents, Spin tickling and applications.   |
| Theory of ESR and instrumentation , g-value, hyperfine splitting qualitative analysis, Kramer's degeneracy.  |
| Instrumentation of ESR differences between ESR and NMR spectra. Qualitative analysis, study of free radicals and other applications.   |
| Mass spectroscopy principle and ion sources, inlets, detectors. Types of peaks, observed resolution qualitative analysis molecular weight determination  |
| Quantitative analysis, advantages chemical analysis of X-RF matrix effects, advantages of X-RF wave length, dispersive technique and evaluation methods.   |
| X-RF energy dispersive technique and evaluation method, applications.<br>Instrumentation of X-RF, matrix effects, and its advantages.  |

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Syllabus for the Academic Year 2013-14

Department :P.G.ANALYTICAL CHEMISTRY

Paper :INSTRUMENTAL METHODS OF ANALYSIS-II

Class: II M.Sc. ANALYTICAL CHEMISTRY

Semester:IV

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| Flame photometry theory, instrumentation combustion flames, detectors, and analysis of Na, K ,Ca and Mg, atomic absorption spectrometer theory and instrumentation, flame techniques.  |
| Resonance line sources, hollow cathode lamp chemical and spectral interferences. applications with special reference to analysis of trace metal in oils, allows and toxic metals in drinking water and effluents.  |
| ICP-AES, ICP-MS principles, instrumentation plasma, AES detectors, quadra-pole mass spectrometers, differences between the two detectors.  |
| Applications of liquids and solids, applications in the analysis of trace and toxic metals in water geological and industrial samples, arc and spark spectrographic direct analysis of solid for metals.   |
| Thermo Gravimetry theory,instrumentation and applications, with special reference to $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ , $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ , $\text{CaCO}_3$ , $(\text{COOH})_2$ .differential thermal analysis- principle, instrumentation, difference between TG and DTA. |
| DTA-applications with special reference to the clays and minerals coals (fuels), differential scanning calorimetry - principle, instrumentation and applications to inorganic materials like chlorates and per chlorates   |
| Determination of ammonium nitrate organic compound and drugs by using DSC. Principle of Polarography, , residual current, migration current ,diffusion current, half wave potential ILKOVIC equation and DME instrumentation.  |
| Advantages & disadvantages, qualitative and quantitative analysis of inorganic ions Cu, Bi , Pb,Cd and Zn. AC polarography, pulse polarography   |
| Principle, instrumentation of HMDE application in the analysis of Pb and Cd in environmental samples.  |
| Principle of cathode stripping voltametry principles of coulometric analysis with constant current coulometric analysis of cations- As(III),Fe(II).  |
| Determination I and $\text{S}^{-2}$ by using $\text{I}_2$ liberations and $\text{Ce}^{+4}$ liberation in solutions coulometric analysis with controlled potentials.  |
| Reference electrodes- hydrogen electrode calomel electrode, silver chloride.   |
| Indicator electrodes- hydrogen electrode, glass electrodes, theory of membrane potentials and glass electrodes, theory of membrane potentials and liquid junction potentials, calibration of ion selective electrodes.   |
| Ion selective electrodes with fixed membrane sited Ag, Pb, Cd, S, F, CN and glass electrodes applications in the analysis of air and water.  |
| Detection and measurements of radio activity introduction to radioactive traces applications of tracer technique.  |
| Isotope dilution analysis applications activation analysis applications advantages disadvantages radio carbon dating technique.  |