BAPATLA ENGINEERING COLLEGE

B A P A T L A

M.Sc. CHEMISTRY

(PREVIOUS: 2015-16)

SYLLABUS

Acharya Nagarjuna University Syllabus for M.Sc., Chemistry

SEMESTER – I

PAPER – I, GENERAL CHEMISTRY 60Hrs.(4Hrs./Week)

UNIT I

Treatment of analytical data : Classification of errors - Determinate and indeterminate errors - Minimisation of errors - Accuracy and precision - Distribution of random errors - Gaussian distribution -Measures of central tendency - Measures of precision - Standard deviation - Standard error of mean -student's t test - Confidence interval of mean - Testing for significance - Comparison of two means – F test- Criteria of rejection of an observation - propagation of errors - Significant figures and computationrules - Control charts - Regression analysis - Linear least squares analysis.

UNIT-II

Titrimetric Analysis:

Classification of reactions in titrimetric analysis- Primary and secondary standards-Neutralisation titrations-Theory of neutralisation indicators-Mixed indicators- Neutralisation curves-Displcement titrations-Precipitation titrations-Indicators for precipitation titrations-Volhard method-Mohr method-Theory of adsorption indicators-Oxidation redution titrations-Change of electrode potentials during titration of Fe(II) with Ce (IV)-Detection of end point in redox titrations-Complexometric titrations- Metal ion indicators-Applications of EDTA titrations-Titration of cyanide with silver ion.

UNIT -III

Visible spectro photometry and potentiometry - Beer-Lambert's law - Deviations from Beers law - Instrumentation - Applications - Photometric titrations - Spectrophotometric determination of pK value of an indicator - Simultaneous spectrophotometric determinations -Advantages of potentiometric methods - Reference electrode - Standard hydrogen electrode . Calomel electrode -Indicator electrodes: Metal-metal ion electrodes - Inert electrodes - Membrane electrodes - theory of glass membrane potential - Direct potentiometry , potentiometric titrations - Applications.

UNIT- IV

Programming in FORTRAN 77 - Flow charts-Constants and variables - Arithmetic expressions -Arithmetic statement - Replacement statement - Input and output statements - Format specifications - Termination statement - Branching statement - IF statement - Arithmetic and logical IF statement - GOTO statement - - Subscripted variable and DIMENSION Statement - DATA Statement. Control statements - DO statement - Rules for DO statements - Functions and subroutines – common statement Flow charts and computer programs for

i) Summing of power series 1+x+x2 +x3 + ….xn
ii) Rate constant of First order reaction or Beer's law by linear least square method.
iii) Hydrogen ion concentration of a strong acid/Quadratic euqation.
iv) Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid.
v) Standard deviation and variance of univariant data.

REFERENCES:

1. Vogel's text book of quantitative analysis. Addition Wesley Longmann Inc.
2. Quantitative analysis R.A Day and A.L.Underwood. Prentice Hall Pvt.Ltd.

3. Principles of computer programming (Fortran 77 IBM PC)V.Rajaraman, Prentice Hall.
4. An introduction to Digital computers.V.Rajaraman and T.Radhakrishnan
5. Fundamentals of Analytical Chemistry - Skoog and West.
6. Basics of computers for Chemists, P.C.Jurs.

PAPER – II, INORGANIC CHEMISTRY 60Hrs.(4Hrs./Week)

UNIT I

Introduction to Exact Quantum Mechanical Results : Schrodinger equation **,** Importance of wave function ,Operators , derivation of wave equation using operator concept . Discussion
of solutions of Shrodingers equation to some model systems viz. particle in one dimensional box
(applications) , three dimensional box ,Rigid rotator system and the Hydrogen atom .
Approximate Methods - Variation theorem , linear variation principle perturbation theory , (first order and non degenerate) . Application of variation method to the Hydrogen atom .
Angular momentum - Eigen functions and Eigen values of angular momentum, Addition of angular moment.

UNIT II

Chemistry of non- transition elements - Inter halogen compounds, Halogen oxides and oxyfluorides . Noble gas compounds with special reference to clathrates. Spectral and Magnetic properties of Lanthanides and Actinides .Analytical applications of Lanthanides and Actinides.
Structure and bonding - pπ - dπ bonding - Evidences (in non-transition metal compounds). Concept of Hybridization , Bent's rule , energetics of Hybridisation , concept of Resonance , Non-valence cohesive forces , Hydrogen bonding -Symmetric and unsymmetric , VSEPR theory , Walsh diagrams for linear(Be H2) and bent (H2O) molecules . Molecular Orbital theory, Symmetry of Molecular orbitals, Molecular orbitals in triatomic (Be H2) molecules and ions (NO2 -) and energy level diagrams . Some simple reactions of covalently bonded molecules.

UNIT III

Metal –ligand bonding - Crystal Field Theory of bonding in transition metal complexes – Splitting of d-orbitals in Trigonal bipyramidal and Square pyramidal fields .Tetragonal distortions - Jahn Teller effect . Applications and limitations of CFT . Experimental evidences for covalence in complexes .Moleccular Orbital Theory of bonding for Octahedral , tetrahedral and square planar complexes .π- bonding and MOT - Effect of π - donor and π - acceptor ligands on Δo . Experimental evidence for π - bonding in complexes.

UNIT IV

Metal – ligand Equilibria in solutions - Step wise and over all formation constants .Trends in stepwise constants (statistical effect and statistical ratio) . Determination of formation constants by Spectrophotometric method (Job's) and pH metric method (Bjerrum's) . Stability orrelations - Irwing – William's series. Hard and soft acidsand bases – Acid-base strength and HSAB , Electronegetivity and HSAB . Macrocyclic complexes - Crown ethers and Cryptates. Preparation and structures of Isopoly and Heteropoly acids and their salts.

Reference Books

1. Inorganic Chemistry Huheey, Harper and Row.
2. Physical methods in inorganic chemistry, R.S. Drago. Affliated East-West Pvt. Ltd.

3. Concise inorganic chemistry, J. D. Lee, ELBS.
4. Modern Inorganic Chemistry , W. L. Jolly, McGrawHill.
5. Inorganic Chemistry , K. F. Purcell and J. C. Kotz Holt Saunders international.
6. Concepts and methods of inorganic chemistry , B. E. Douglas and D.H.M.C. Daniel, oxford
Press.
7. Introductory quantum mechanics , A. K. Chandra
8. Quantum Chemistry ,R. K. Prasad.
9. Inorganic Chemistry ,Atkins, ELBS
10. Advanced Inorganic Chemistry ,Cotton and Wilkinson, Wiley Eastern
11. Quantum Chemistry ,R. K. Prasad.
12. Text book of Coordination chemistry , K.SomaSekhar rao and K.N.K. Vani, Kalyani Publishers .

PAPER – III, ORGANIC CHEMISTRY; 60Hrs.(4Hrs./Week)

UNIT-I

a) **Nature of Bonding in Organic Molecules:** Localised and Delocalized covalent bonds, Delocalised chemical bonding conjugation, cross conjugation, hyper conjugation,tautomerism.

b) **Aromaticity**: Concept of aromaticity, Aromaticity of five membered, six membered rings and
fused systems.- Non benzonoid aromatic compounds:-cyclopropenyl cation, cyclobutadienyl dication, cyclopentadienyl anion-tropyllium cation and cyclo octatetraenyl dianion. - Metallocenes, Ferrocene, Azulenes, Fulvenes, Annulenes, Fullerenes. - Homo aromaticity, Anti aromaticity and pseudo (□) aromaticity.

UNIT – II

REACTIVE INTERMEDIATES AND HETEROCYCLIC COMPOUNDS:

a) **Reactive Intermediates**:- Generation, Structure, Stability and reactivity of Carbocations, Carbanions, free radicals, Carbenes, nitrenes and Benzyne.

b) **Heterocyclic Chemistry**:- Synthesis and Ractions of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole; Skraup synthesis, Fisher indole synthesis.

c) Heterocyclic compounds more than one hetero atom: - Pyrazole, Imidazole, Oxazole Iso-Oxazole, Thiazole, isothiazole, synthesis and properties.

UNIT - III

STEREOCHEMISTRY:

a) Concept of Chirality: Recognition of symmetry elements and chiral structures (one and more than one chiral centers); D-L and R – S nomenciature, diastereoisomerism; Interconversion of Fischer, Newman and Sawhorse projections. Threo and Erythro isomers, methods of resolution, stereospecific and stereoselective synthesis. Asymmetric synthesis. - Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes). b) Geometrical isomerism – E, Z- nomenclature – physical and chemical methods of determining the configuration of geometrical isomers.

c) Stereochemistry of compounds containing nitrogen, sulphur and phosphorous.

UNIT – IV

CONFORMATIONAL ANALYSIS:

a) Conformation of acyclic molecules – alkanes and substituted alkanes –compounds having intramolecular hydrogen bonding, conformations around C-C and carbon hetero atom bonds

having C – O & C – N.
b) Conformations of monocyclic compounds – cyclohexane- chair, boat and twist boat cyclo hexanes, energy profile diagram – Mono and di- substituted cyclohexanes – conformations and physical properties. Effect of conformation on reactivity in mono and disubstituted cyclohexane derivatives.
c) Elementary treatment of fused and bridged ring systems – Decalines and Bornanes. Conformation of sugars, steric strain due to unavoidable crowding.

Reference Books

1. Advanced organic chemistry – reaction, mechanism and structure, Jerry March, John Wiley.
2. Advanced organic chemistry, F.A.Carey and R.J.Sundberg,Plenum.
3. A guide book to Mechanism in organic chemistry, Peter Sykes, Longman.
4. Organic chemistry, I.L.Finar, Vol. I & II, Fifth ed. ELBS, 1975.
5. Organic chemistry, Hendrickson, Cram and Hammond (Mc Graw – Hill).
6. Stereo Chemistry of carbon compounds – E.L. Eliel.
7. Modern organic Reactions, H.O. House, Benjamin.
8. An introduction to chemistry of Heterocyclic compounds, R.M.Acheson.
9. Structure and mechanism in organic chemistry, C.K.Ingold, Cornell University Press.
10. Principles of organic synthesis, R.O.C.Norman and J.M.Coxon, Blakie Academic & Professional.
11. Reaction Mechanism in Oganic Cemistry, S.M.Mukherji and S.P.Singh, Macmillan.
12. Basic Principles of Organic Chemistry by J. B. Roberts and M. Caserio.
13. Stereochemistry of Organic compounds, P. S. Kalsi, New Age International.

PAPER – IV, PHYSICAL CHEMISTRY 60Hrs.(4Hrs./Week)

UNIT-I

Thermodynamics - I

Classical thermodynamics - Brief review of first and second laws of thermodynamics - Entropy change in reversible and irreversible processes - Entropy of mixing of ideal gases - Entropy and disorder – Free energy functions - Gibbs-Helmoboltz euqation - Maxwell partial relations - Conditions of equilibrium and spontaneity - Free energy changes in chemical reactions: Van't Hoff reaction isotherm - Van't Hoff equation - Classiuss Clapeyron equation - partial molar quantities - Chemical potential - Gibbs- Duhem equation - partial molar volume - determination of partial molar quantities - Fugacity - Determination of fugacity - Thermodynamic derivation of Raoult's law.

UNIT – II

Surface phenomena and phase equilibria - Surface tension - capillary action - pressure difference - across curved surface (young - Laplace equation) - Vapour pressure of small droplets (Kelvin equation) - Gibbs-Adsorption equation - BET equation - Estimation of surface area - catalytic activity of surfaces – ESCA , X- ray flouresence and Augar electron spectroscopy.

Surface active agents - classification of surface active agents - Micellisation - critical Micelle

concentration (CMC) - factors affecting the CMC of surfactants, microemulsions - reverse micelles - Hydrophobic interaction.

UNIT - III

Electrochemistry – I - Electrochemical cells - Measureement of EMF - Nernst equation – Equilibrium constant from EMF Data - pH and EMF data - concentation cells with and without transference – Liquid junction potential and its determination - Activity and activity coefficients - Determination by EMF Method - Determination of solubility product from EMF measurements. Debye Huckel limiting law and its verification. Effect of dilution on equivalent conductance of electrolytes - Anamolous behaviour of strong electrolytes.Debye Huckel-Onsagar equation - verification and limitations - Bjerrum treatment of electrolytes conductometric titrations.

UNIT - IV

Chemical kinetics- Methods of deriving rate laws - complex reactions - Rate expressions for opposing, parallel and consecutive reactions involving unimolecular steps. Theories of reaction rates - collision theory - Steric factor - Activated complex theory - Thermodynamic aspects – Unimolecular reactions - Lindemann's theory - Lindemann-Hinshelwood theory. Reactions in solutions - Influence of solvent - Primary and secondary salt effects - Elementary account of linear free energy relationships - Hammet - Taft equation - Chain reactions - Rate laws of H2-Br2, photochemical reaction of H2 - Cl2 Decomposition of acetaldehyde and ethane - Rice-Hertzfeld mechanism.

REFERENCES:

1. Physical Chemistry P.W.Atkins, ELBS
2. Chemical Kinetics - K.J.Laidler, McGraw Hill Pub.
3. Text Book of Physical Chemistry. Samuel Glasstone, Mcmillan Pub.
4. Physical Chemistry, G.W.Castellan. Narosa Publishing House
5. Thermodynamic for Chemists. Samuel Glasstone
6. Electrochemistry,Samuel Glasstone, Affiliated East West
7. Physical Chemistty,W.J.Moore, Prentice Hall
8. Atomic structure and chemical bond. Manas chanda. Tata McGraw Hill Company Limited.

M.Sc. CHEMISTRY PEVIOUS PRACTICALS (I SEMESTER)

INORGANIC CHEMISTRY (PRACTICAL-I)

Quantitative Analysis:

A. Volumetric Analysis:
    1. Acid-Base Titrations:
        a. Determination of a mixture of carbonate and hydroxide- Analysis f commercial caustic soda
B. Red-Ox Titrations:
    1. Determination of Ferrous ammonium sulphate (Fe^{+2} ions)by titrating against $KMnO_4$
    2. Determination of Ferous ammonium sulphate (Fe^{+2} ions) by titrating against $K_2Cr_2O_7$
C. Complexometric Titrations:
    1. Determination of Mg^{+2} ions by titrating against EDTA
    2. Determination of Hardness of water
    3. Determination of Ni^{+2} ions by titrating against EDTA
D. Miscellaneous Titrimetric Determinatiobns
    1. Determination of Zn^{+2} ions by titrating against $K_4[Fe(CN)_6]$

Gravimetric Analysis

1. Determination of Ni as Nickel dimethyl glyoxime
2. Determination of Zn as Zinc Ammonium phosphate
3. Determination of Cu as cuprous thiocyanate

ORGANIC CHEMISTRY (PRCTICAL-II)

Preparation and purification of organic compounds involving 1 & 2 steps. (minimum of 5 each compounds)

Single step

1. Asprin
2. Iodoform
3. m-dinitrobenzene
4. p-bromo Acetanilide
5. Acetnilide

Two step

1. P-nitro acetanilide from aniline
2. Phthalamide from Phthalic acid
3. 2,4-dinitro phenyl hydrazine from chlorobenzene'

4. M-nitro phenol from m-dinitrobenzene
5. M-dinitribenzene from benzene

PHYSICAL CHEMISTRY (PRACTICAL III)

1. Distribution coefficient of Benzoic acid between benzene and water
2. Determination of equilibrium constant of KI_3 $KI + I_2$ by partition coefficient method and determination of unknown concentration of potassium iodide
3. Determination of rate constant of oxidation of iodide ion with persulphate ion.
4. Determination of rate constant of sodium formate and iodine
5. Relative strengths of acids by studying hydrolysis of ethyl acetate/methylacetate
6. Determination of critical solution temperature of phenol-water systemand study of the effect of electrolyte on the miscibility of phenol-water system
7. Adsorption of acetic acid on charcoal
8. Determination of the formula of cuprammonium cation.

SEMESTER-II

PAPER – I, GENERAL CHEMISTRY 60Hrs.(4Hrs./Week)

UNIT-1

Symmetry and Group theory in Chemistry - Symmetry elements, symmetry operation, definition of group, suib group, relation between order of a finite group and its sub group. Point symmetry group. Schonfiles symbols, representation of groups by Matrices (representation for the Cn, Cnv, Cnh, Dn etc. groups to be worked out, explicitely). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use. Application of group theory in IR and Raman spectroscopy.

UNIT – II

Motion of molecules-Degrees of freedom –Energy associates with the degrees of freedom Type of spectra **Microwave spectroscopy.** Classification molecules, rigid rotator model, effect of isotopic substitution on the transition frequency Intensities non-rigid rotator-Microwave spectra of polyatomic molecules.

Infared spectroscopy

Harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths, anhoremonicity Morse potential energy diagram. Vibration – rotation spectroscopy. PQR braches, Born – oppenheimer approximation, Break down Born – openheimer approximation, selection rules, normal modes of vibration group frequencies, overtones, hot bands, application of IR spectra to polyatomic molecules.

UNIT – III

Raman spectroscopy.

Classical and quantum theories of Raman effects, pure rotational, vibrational and Vibrational – rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent antistrakes Raman Spectroscopy (CARS) – Application.

Visible and ultraviolet spectroscopy: - Electronic Spectra of diatomic molecules, vibrational structure of an electronic transition, classification of bands, rotational fine structure of electronic vibrational transition. Electronic Spectra of Polyatomic Molecules – Instrumentation – applications.

UNIT – IV

Nuclear Magnetic Resonance Spectroscopy: -

Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its

measurements, factors influencing chemical shift, desheilding, spin – spin interactions, factors

influencing, coupling constant J. Classification (ABX, AMX, ABC, A2, B2 etc.) Basic ideas about instrument NMR studies of nuclei other than proton – 13C, 19F, 31P. Use of NMR in medical diagnostics.

Electron spin resonance spectroscopy. : -

Basic principles, zero field splitting and kranners's degeneracy, factors affecting the 'g' value. Istropic and anisotropic hyperfine coupling constants, spin hamiltenia, Spin densities measurement techniques - applications.

SUGGESTED BOOKS:

1.Fundamentals of Molecular spectroscopy: by C.N.Banwell
2.Introductory Group Theory for Chemists – George Davidson
3.Group theory for chemistry – A.K.Bhattacharya
4.Molecular spectroscopy by B.K.Sharma
5. Vibrational Spectroscopy by D.N.Sathyanarayana New Age Int. Pub.
6. Spectroscopy by Aruldas.
7. Chemical Analysis by H.A.Laitinan and W.E.Harris, McGraw Hill.

PAPER-II INORGANIC CHEMISTRY 60 Hrs (4 Hrs/WEEK)

UNIT I

Non metal cages and metal clusters:

Nonmetal cages, structure and bonding in phosphorous- oxygen and phosphorous -sulphur cages; structure and bonding in higher boranes with (special reference to B12 icosahedra). Carboranes , metalloboranes, metallo carboranes.

Metal clusters: Classification- LNCs and HNCs **,**Isoelectronic and Iso lobal relation ships , electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structrure and bonding in dinuclear [Re2Cl8] 2- ion, trinuclear [Re3Cl9] , tetra nuclear W4OR16, hexa nuclear [Mo6Cl8]4+ and [Nb6Cl12]2+ poly atomic Zintle ions and Chevrel phases. Applications of clusters

Metal π- complexes: preparation, structrure and bonding in Nitrosyl ,Dinitrogen and Dioxygen
complexes.

UNIT II

Organometallic complexes of transition metals: Classification and electron counting rules. Metallocenes with four, five, six, seven and eight (□4 - □8) membered rings, synthesis, structure and bonding of Ferrocene. Cyclopenta dienyl, Arene, Cyclohepta triene and Tropylium complexes of transition metals. Reactions of organometallic compounds oxidative addition reductive elimination, insertion and elimination. Applications of organometallic compounds- Catalytic hydrogenation, Hydro formylation Zeigler- Nutta catalyst for polymerization of olefins.

Bio chemical aspects of iron and cobalt: Binding, storage and transport of dioxygen by Hemoglobin and Myoglobin. Vitamin B12 and its importance.

UNIT III

Reaction mechanism of transition metal complexes:

Kinetics of octahedral substitution, acid hydrolysis, base hydrolysis -conjugate base(CB) mechanism. Direct and indirect evidences in favour of CB mechanism. Anation reactions. Reactions without metalligand bond cleavage. Factors affecting the substitution reactions in octahedral complexes. Trans effect on substitution reactions in square planar complexes. Mechanism of redox reactions, outer sphere mechanism, cross reactions and Marcus –Hush equation, inner sphere mechanism, complementary and non – complementary reactions.

Photo reactions: Introduction, Adamsons rules, photo redox reactions, photo isomerisation, photo anation and photo aquation reactions. Photo chemical decomposition of water, photo reactions of Fe(II) and Fe(III).

UNIT IV

Electronic spectra of transition metal complexes Electronic configurations and Spectroscopic terms . Selection rules , Slator – Condon parameters , Racah parameters , Term separation energies for dn configurations Correlation diagrams and Orgel diagrams . Tanabe- Sugano diagrams for d1 to d9 configurations . Calculations of Dq ,B and β parameters . Charge transfer spectra .

Magnetic properties of transition complexes Types of magnetism , factors affecting paramagnetism , anomalous magnetic moments - Orbital and spin contribution , spin - orbit coupling and magnetic moments.Chiroptical properties ,Cotton effect and Faraday effect .

References:

1. Inorganic Chemistry , Huheey. Harper and Row.
2. Concise inorganic chemistry ,J. D. Lee, ELBS.
3. Inorganic chemistry ,K.F. Purcell and J.C. Kotz, Holt Saunders international
4. Organometallic chemistry ,R.C. Mehrotra and A. Singh. New Age International.
5. Advanced Inorganic Chemistry ,Cotton and Wilkinson, Wiley Eastern
6. Inorganic reaction mechanism , Basolo and Pearson, Wiley Eastern
7. Bioinorganic Chemistry ,K. Hussan Reddy
8. Biological Aspects of inorganic chemistry , A. W. Addiso, W. R. Cullen, D. Dorphin and G. J.
james. Weliey Interscience.
9. Photochemistry of coordination compounds, V.Balzaniand V.Carassiti. Academic Press
10. Text book of Coordination chemistry by K.SomaSekhar rao and K.N.K. vani, Kalyani Publishers .

PAPER – III, ORGANIC CHEMISTRY; 60Hrs. (4Hrs./Week)

UNIT – I

SYNTHETIC METHODS AND NAMED REACTIONS

a) General Methods for synthesis:

Additions: Addition to carbon – carbon multiple bonds, HX, X2, HOX, stereo chemistry of addition, formation and reaction of epoxides, syn and anti hydroxylation, hydrogenation(catalytic and Non catalytic), sythetic reactions of CO and CN and Cram's rule.

b) Familiar Name Reactions and Mechanisms:

Benzoin, cannizaro, Perkin, Dieckmann and Stobbe condensations; Hofmann, Schmidt,Lossen, Curtius, Clasien, Backmann and Fries rearrangements; Reformatsky, Favoursky,Mannich reaction, Baeyer Villiger reaction and Chichibabin reaction, Michael addition,Oppenaur oxidation, Clemmensen, Wolff-Kishner, Meerwein–Ponndorf–Veriey and Birch reductions.

UNIT-II

a) Aliphatic Nucleophilic substitutions:

The SN2 , SN1, mixed SN1 and SN2 and SNi reactions : Mechanism, effect of structure, nucleophile, leaving group.. The neighbouring group mechanism, neighbouring group participation by □ and □ bonds, anchimeric assistance.

b) **Aromatic Nucleophilic substitution:**

The SNAr , SN1 mechanisms and benzyne mechanism. Reactivity- effect of substrate structure,
leaving group and attacking nucleophile. The Von-Ritcher, Sommelet – Hauser and Smiles rearrangements.

UNIT –III

Eliminations and protecting agents :

a) Types of elimination (E1,E1CB,E2) reactions, mechanisms, stereochemistry and orientation,

Hofmann and Saytzeff's rules, Syn elimination versus anti elimination. Competitions between

elimination and substitution.

b) Dehydration, dehydrogenation, decarboxylative elimination, pyrolytic elimination, molecular rearrangement during elimination.

c) Theory and importance of functional group protection in organic synthesis:- Protecting agents for the protection of functional groups Hydroxyl group, Amino group, Carbonyl group and Carboxylic acid group

UNIT – IV

CHEMISTRY OF NATURAL PRODUCTS:

a) **Alkaloids:** General methods of identification of alkaloids, Structure and synthesis of Atropine,

Berberine and Yohimbine.

b) **Lower Terpinoids:** General methods of identification of terpnoids, Isoprene rule, biogenetic

isoprene rule and classification of terpenes. Structural elucidation and synthesis of □-terpeniol,α-pinene and camphor.

c) **Quinones:** Identification of quinones , Lapachol. Chrysophenol and Physcion.

Books suggested:

1. Advanced organic chemistry – reaction, mechanism and structure, Jerry March, John Wiley.
2. Advanced organic chemistry, F.A.Carey and R.J.Sundberg, Plenum.
3. A guide book to Mechanism in organic chemistry, Peter Sykes, Longman.
4. Organic chemistry, I.L.Finar, Vol. I & II, Fifth ed. ELBS,1975.
5. Organic chemistry, Hendrickson, Cram and Hammond (Mc Graw – Hill).
6. Stereo Chemistry of carbon compounds – E.L. Eliel.
7. Modern organic Reactions, H.O.House, Benjamin.
8. An introduction to chemistry of Heterocyclic compounds, R.M.Acheson.
9. Structure and mechanism in organic chemistry, C.K.Ingold, Cornell University Press.
10. Principles of organic synthesis, R.O.C.Norman and J.M.Coxon, Blakie Academic & Professional.
11. Reaction Mechanism in organic chemistry, S.M.Mukherji and S.P.Singh, Macmillan.
12. Nturally occurring quinines – R. H. Johnson Vol. I & II, Academic Press, London.

PAPER – IV, PHYSICAL CHEMISTRY 60Hrs.(4Hrs./Week)

UNIT – I:

Thermodynamics II : Third law and Statistical thermodynamics-Nernst Heat theorem - Third law of thermodynamics - Its limitations - Determination of absolute entropy - concept of distribution - Thermodynamic probability and most probable distribution - Ensemble-ensemble averaging - Maxwell-Boltzmann distribution law - Partition function - Fermi-Dirac statistics - Bose Einstein statistics - Entropy and probability - Boltzmann-Plank equation - calculation of thermodynamic properties in terms of partition function - Application of

partition function - Chemical equilibrium and partition function - Translational, rotational and electronic partition function - Entropy of Monoatomic gases (Sackur - Tetrode equation).

UNIT –II

Polymer chemistry: Classification of polymers - Free radical , ionic and Zeigler -Natta Polymerisation - kinetics of free radical polymerisation - Techniques of polymerisation - Glass transition temperature - Factors influencing the glass transition temperature - Number average and Weight average, Molecular weights –molecular weights determination - End group analysis - Osmometry - Light scattering and ultra centrifugation methods.

UNIT – III:

Electro Chemistry-II : Electrode potentials - Double layer at the interface - rate of charge transfer - Decomposition potential - Over potential - - Tafel plots - Derivation of Butler-Volmer equation for one electron transfer - electro chemical potential.

Electro catalysis - - Fuel cells-Theory of polarography - Diffusion current - Ilkovic equation – Equation for half- wave potential –Applications of polarography - Amperometric titrations - Corrosion - Forms of corrosion - prevention methods.

UNIT – IV

Chemical kinetics and photo chemistry - Branching Chain Reactions - Hydrogen-oxygen reaction - lower and upper explosion limits - Fast reactions - Study of kinetics by flow methods -

Relaxation methods - Flash photolysis - Mechanism of homogeneous catalysis - Acid base catalysis - protolytic and prototropic mechanism - Enzyme catalysis - Michelis-Menten kinetics.

Photochemical reactions - Quantum yield and its determination - Actinometry - Reactions with low and high quantum yields - Photo sensitisation - Exciplexes and Excimers - Photochemical equilibrium - Chemieluminescence-Kinetics of collisional quenching-Stern - Volmer equation - Photo Galvanic cells

REFERENCE BOOKS:

1. Physical chemistry, G.K.Vemulapalli (Prentice Hall of India).
2. Physical chemistry, P.W.Atkins. ELBS
3. Chemical kinetics - K.J.Laidler, McGraw Hill Pub.
4. Text book of Physical Chemistry, Samuel Glasstone, Macmillan pub.
5. Statistical Thermodynamics - M.C.Gupta.
6. Polymer Sceince, Gowriker,Viswanadham, Sreedhar
7. Elements of Nuclear Science, H.J.Arniker, Wiley Eastern Limited.
8. Quantitative Analysis, A.I. Vogel, Addison Wesley Longmann Inc.
9. Physical Chemistry-G.W.Castellan, Narosa Publishing House, Prentice Hall
10. Physical Chemistry, W.J.Moore, Prentice Hall
11. Polymer Chemistry - Billmayer
12.Fundamentals of Physical Chemistry, K K

M.Sc ., Chemistry Previous Practicals (II Semester)

Inorganic Chemistry (Practical-I):

Qualitative Analysis:

Semimicro qualitative analysis of an inorganic mixture containing three catations (one less familiar cation) and three anions (one interfering anion)

Less familiar cations: Tl, Mo,Th,Zr,V and U.
Interfering anions: Oxalate, tartrate, phosphate and chromate.

Chromatography:

Separation of cation and anion by Paper Chromatography (at least one experiment)

Organic Chemistry (Practical-II):

Qualitative Analysis of organic compounds.

Phenols, Carbonyl compounds (Aldehydes & Ketones), Acids, Nitro compounds, Amines, Amides and carbohydrataes.(2 compounds are to be given for analysis with preparation of one solid derivative for each).

Physical Chemistry (Practical-III):

Potentiometric determinations of

1. Fe(II) with Ce(IV)
2. Fe(II) with $K_2Cr_2O_7$
3. V^{5+} &MnO_4^- with Fe(II)

Conductometric titrations of

1. Strong acid (HCl) with strong base (NaOH)
2. Weak acid (AcOH) with strong base (NaOH)
3. Mixture of strong &weak acids with strong base.

p^H metric titrations of

1. Strong acid with strong base
2. Mixture of carbonate and bicarbonate with HCl

Colorimetry:

1. Verification of Beers Law with 1. $K_2Cr_2O_7$
2. Colorimetric determination of Fe (III) with thiocyanate.

BAPATLA ENGINEERING COLLEGE

B A P A T L A

M.Sc. CHEMISTRY

(Specialization: ANALYTICAL)

(FINAL: 2015-16)

SYLLABUS

Acharya Nagarjuna University Syllabus for M.Sc., Chemistry
SEMESITER III

PAPER –I: PRINCIPLES AND TECHNIQUES IN CLASSICAL ANALYSIS (C3.1(A)-10)

UNIT-I

Theory and principles of titrimetric analysis:

Acid - Base Titrations: Titrimetric procedures involved in the neutralization of acids and bases; Acid base indicators-indicator action-preparation of indicator solutions-mixed and universal indicators.,

Redox Titrations: Theoretical principles - red ox indicators-Indicator action. Analytical chemistry of some selected oxidants/reductants, selection of suitable indicators for various oxidant/reductant titration systems.

Oxidants: Mn(III),Mn(VII),Ce(IV),Cr(VI),V(V),Ti(III),Iodimetry and iodometry,

Reductants:Cr(II), V(II), Ti(III,Sn(II),

Use of Karl-Fisher reagent in the estimation of moisturecontent,

UNIT - II

Titration In Non-Aqueous Solvents:Choice of solvents for non-aqueous titrations.End point detection- Applications of non-aqueous titrations using glacial acetic acid as titre. **Complexometric Titrations**: Theoretical principles involved in complexometric titrations -role of indicators, EDTA titrations, Silver cyanide titration, Direct titration, back titration,substitution titration,total hardness of water,floride ion as demasking agent- analysis of nickel alloy. PRECIPITATION TITRATIONS: Theoretical principles involved in argentometric titrations-use of normal and adsorption indicators -Indicator action.,

UNIT-III

Gravimetric Analysis :Precipitation methods: Nucleation and crystal growth, completeness of precipitation, effect of excess precipitant, pH, complex formation on completeness of precipitation, purity of the precipitate, precipitation from the homogeneous solutions.

Analytical Applications of organic precipitants in gravimetric analysis- Structural requirements of an organic precipitant- -Specificity, selectivity, sensitivity, masking.

Complexing precipitants like DMG, Oxine, Salicylaldoxime, a-Benzoinoxime.

Ion association precipitants:Benzidene,Sodium tetra phenyl boron,arsonium salts.

UNIT-IV

Catalysed And Induced Reactions And Kinetic Methods Of Nalysis: Kinetic aspects of the analytical use of chemical reactions-Kinetics of chemical reactions-Kinetic effects in oxidation reduction reactions.

Application of kinetic methods: catalytic reactions-enzyme reactions-uncatalysed reactions-determination of components, determination of the rate with change of concentration,

Types of kinetic methods: single point method ,Differential method,Integral method, Rate determination by complex decomposition, by steady state condition,Kinetics of enzyme catalysed reactions- Factor effecting- activators, inhibitors, hydrogen ion concentration, temperature-Principles of the analytical use of enzyme reactins-Determinaiotn of enzymes.

SUGGESTED BOOKS:

1. I.M.Kolthoff-Volumetric analysis V.A.Strenger Vols I to III,
2. A.I.Vogel - A text Book of quantitative Inorganic analysis - ELBS,
3. H.P.Walton- Principles and methods of chemical analysis-Prentice Hall,
4. Laitnen-Chemical Analysis,
5. C.W.Wilson and D.W.Wilson-Comprehensive analytical Chemistry,
6. R.A.Day Jr and A.L.Underwood-Quantitative analysis-Prentice Hall,
7. K.B.Yarstimiskii-Kinetic Methods of Analysis,
8. D.A.Skoog,D.M.West and F.J.Holler--Fundamentals of Analytical Chemistry .

PAPER- II: APPLIED INORGANIC ANALYSIS (C3.2(A)-10)

UNIT-I

Analysis of Limestone: moisture,loss on ignition,insoluble matter (silica), determinaitono of combied oxides(R_2O_3), calcium, magnesium, , carbon dioxide.
Analyisis of haematite, - moisture, volatile matter, silica, iron, oxide iron,
Analyisis of pyrolusite- moisture,volatile matter, silica, manganese, combined oxides
Analysis of clay materials: moisture,volatile matter, silica, R_2O_3,Fe_2O_3,

UNIT II

Analyisis of phosphate rock- moisture, loss on ignition, SiO2, allumina,Fe_2O_3, toal CaO,magnesium.
Analyisis of feldspar- silica, sodium, potassium,sulphatee ,
Analyisis of monozite- oxides of cerium, thorium, calcium, magnesium, iron, aluminium , sulphur, silica.

UNIT-III

Analysis of ferrous alloys:
Analysis of Steels- types of steels- digestion methods for different types of steels- determianiton of contents of carbon, silicon,sulphur , phosphorous, manganese,nickel magnesium, vanadium, molybdenum, nickel, aluminium, chromium and tungsten in steel samples.
Analysis of non- ferrous alloys:
Brass, bronz and solder:Composiitons of different alloys- digestion procedures of alloys- Procedures for the determiantion of contents like tin, copper, lead,zinc and iron ,aluminium, manganese, antimony,

UNIT – IV

Analysis of Complex materials:
Analysis of cement- loss on ignition, insoluble residu, total silica, sesqui oxides, lime, magnesia, ferric oxide, sulphuric anhydrid.
Analysis of glasses - Determinaiton of silica, sulphuur, barium, arsinic, antimony, total R_2O_3, calcium, magnesium, total alkalies,aluminium,chloride,floride
Colouring agents in galss- chromium, cobalt,copper, total iron, manganese, nickel,titanium, lead, barium,sodium, potassium, cerium, zirconium, arsenic,

SUGGESTED BOOKS:

1. F.J.Welcher-Standard methods of analysis,
2. I.M.Kolthoff-Volumetric analysis V.A.Strenger Vols I to III,
3. A.I.Vogel - A text Book of quantitative Inorganic analysis - ELBS,
4. H.P.Walton- Principles and methods of chemical analysis-Prentice Hall,
5. Laitnen & Harris -Chemical Analysis,
6. C.W.Wilson and D.W.Wilson-Comprehensive analytical Chemistry,
7. F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,
8. Mannual of procedures for Chemical and instrumental analysis of Ores, Minerals and Ore Dressing Porducts-Published by Indian Bureau of Mines, Mistry of Steel and Mines, Nagpur

PAPER –III: ANALYSIS of APPLIED INDUSTRIAL PRODUCTS (C3.3(A)- 10)

UNIT-I

Analysis of soaps: moisture and volatile matter, combined alkali, total fatty matter, free alkali, total fatty acid, sodium silicate and chlorides. Analysis of paints :Vehicle and pigments ,Barium Sulphate ,total lead, lead chromate, iron pigments, zinc chromate

UNIT- II

Analysis of oils: saponification value, iodine value, acid value, ester value, bromine value, acetyl value Analysis of industrial solvents like benzene, acetone, methanol and acetic acid. Determination of methoxyl and N-methyl groups.

UNIT-III

Analysis of fertilizers: urea, NPK fertilizer, super phosphate, Analysis of DDT, BHC, Endrin, endosulfone, malathion, parathion., Analysis of starch, sugars, cellulose and paper,

UNIT -IV

Gas analysis: carbon dioxide, carbon monoxide, oxygen, hydrogen, saturated hydro carbon, unsaturated hydrocarbons, nitrogen, octane number, cetane number Analysis of Fuel gases like: water gas, producer gas, kerosene (oil) gas. Ultimate Analysis: carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur.,

SUGGESTED BOOKS:

1. F.J.Welcher-Standard methods of analysis,
2. A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,
3. H.H.Willard and H.Deal- Advanced quantitative analysis- Van Nostrand Co,
4. F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,
5. J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on analytical chemistry and its applications -- Inter Science- Vol I to VII.,
6. G.Z.Weig - Analytical methods for pesticides,plant growth regulators and food additives - Vols I to VII,
7. Aanalytical Agricultrual Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
8. Mannual of soil, plant, water and fertilizer analysis, R.M.Upadhyay and N.L Sharma,Kalyani Publishers,New Delhi.

PAPER –IV: OPTICAL METHODS OF ANALYSIS AND OTHER TECHNIQUES C3.4 (A) -10)

UNIT – I:

Infrared Spectroscopy :- Theory – Molecular Vibrations – Instrumentation- Limitations – Structure determination – Quantitative Analysis – Base line techniques.

Raman Spectroscopy: - Theory – Properties of Raman lines – Differences between Raman & IR Spectra – Rayleigh scattering – Mechanism of Raman effect – Instrumentation – Applications.

UNIT – II :

Nephelometry & Turbidimetry : - Theory – Instrumentation – Difference between Nephelometry & Turbidimetric titrations – Applications.

Flourimetry & Phosphorimetry : - Theory – Flourescence & Phosphorescence – factors effecting Flourescence & Concentration – Limitations – Comparison of Flourimetry & Phosphorimetry – Applications.

UNIT – III: -

Emission Spectroscopy: - Principle – Theory – Instrumentation – Types responsible for Line Spectra – Merits & Demerits – Applications.

Flame Photometry: Principle –Theory– Instrumentation–Experimental Procedures– rrors in Flame Photometry – Applications.

Atomic Absorption Spectroscopy: - Principle – Theory – Limitations – Relation between Atomic absorption& Flame emission – Instrumentation Estimation of cation & anions – Applications.

Inductively Coupled Spectrometer: - Principles – Instrumentation – Advantages over Atomic **Absorption Spectroscopy** – Applications with specific examples like Chromium, Molybdenum, Zirconium and Aluminium.

UNIT – IV: -

Thermal analysis techniques: - Thermogravimetric Analysis – Types of Thermal balances – Differential Thermal Analysis – Differential scanning calorimetry- Thermometric Titrations.

Radio Chemical Methods: -Objectives, introduction, principles and theoretical aspects, technique/ method, gas counter, scintillation counter, errors and correction, liquid scintillation counting, sample preparation, applications

SUGGESTED BOOKS:

1. B.K.Sharma -- Instrumental methods of chemical analysis,Goel Publishers,
2. G.Chatwal and S.Anand --Instrumental methods of chemical analysis,,
3. A.I.Vogel -- A text Book of Quantitative Inorganic Analysis-ELBS,
4. H.H.Willard,LL Merrit and JA Dean -- Instrumental Methods of Analysis.,
5. Peace-Instrumental Methods of Analysis,
6. J.W.Robbinson- Under graduate Instrumental Analysis,
7. G.W Eving- Instrumental Methods of Chemical Analysis.,
8. D.A.Skoog,D.M.West and F.J.Holler--Fundamentals of Analytical Chemistry ,
9. H.Kaur-- Instrumental methods of chemical analysis,Pragathi Prakasan,
10. D.A.Skoog,F.J.Holler and Nieman-- Instrumental Methods of Analysis.,

Acharya Nagarjuna University

M sc Final Year Chemistry (Analytical Chemistry Specialization) IIIrd semester
Effective for the Students admitted from the year 2014-2015

Practicals for the examinations to be conducted at the end of the IV semester

Practical- I Classical Methods of Analysis

1. Analysis of Iron ore
2. Analysis of pyrolusite
3. Synthetic mixture of Iron / Zinc
4. Analysis of total hardness in water
5. Estimation of Glucose
6. Analysis of Oil for the determination of Iodine value and saponification value
7. Analysis of chloride in water samples
8. Analysis of Nickel by EDTA

Practical-II Instrumental method Analysis

1. Potentiometric titrations of Fe(II) with Cr(VI)
2. Estimation of Chloride and Iodine in a mixture by Potentiometric method.
3. Estimation of Mn(VII) with Iron(II) by Potentiometric method.
4. Commercial acids by P^H Metric titration using suitable base
5. Conductometry titration with individual acids and mixture of acids
6. Determination of Fe(III) calorimetrically using potassium thiocynate
7. Estimation of Manganese by environmental samples by colorimetric method

Acharya Nagarjuna University Syllabus for M.Sc., Chemistry
SEMESITER IV

PAPER –I ADVANCED METHODS OF ANALYSIS (C4.1 (A-10)

UNIT-I

Mass Spectrometry: Principle-theory-instrumentation-interpretation of spectra of metal compounds- identification of compounds of metal compounds from fragmentation pattern. Quantitative analysis of metal chelates-alkaline earth metal derivatives, metal chelates derived from 8-hydroxyquninoline, Schiff's bases-Salicylaldoxime, nitrogen rule, thermodynamic studies-molecular structure Analytical aspects of the mass spectrometry.

UNIT-II

X-RAY SPECTROSCOPY: Principles-theory, X-ray diffraction -instrumentation -X-ray fluorescence- applications-identification of substances by the powder diffraction method-applications.

UNIT-III

Electron Paramagnetic Resonance Spectroscopy (EPR):

Principle-theory-instrumentation -hyperfine interactions-determination of 'g' value-endor and eldor applications-study of free radicals-structural determination-reaction velocities and mechanisms-study of inorganic compounds-study of catalysis determination of oxidation state of metal determination of manganese-determination of vanadium.

UNIT-IV

Nuclear magnetic resonance spectroscopy (NMR):

Principles-theory-instrumentation-differences between NMR and EPR-chemical shift-spin-spin coupling effect of chemical exchange on spin-spin interactions-spin decoupling-limitations of NMR-cause of chemical shift and shielding-applications-qualitative and quantitative analysis-kinetic studies.,

SUGGESTED BOOKS:

1.Becky -- Ionization mass spectrometry,
2.Physical methods of Analytical Chemistry Vol I - III,
3 J.Roilly and W.N.Ray --Physical Chemical Methods,
4.Advances in Analytical Chemistry and Instrumentation. Vol I - IV,
5.T.H.Gouw- Guide to modern methods of instrumental analysis,
6.A.I.Vogel -- A text Book of Quantitative Inorganic Analysis-ELBS,
7.P.Delahay --New instrumental methods in Analytical Chemistry,
8.H.H.Willard,LL Merrit and JA Dean -- Instrumental Methods of Analysis.,
9.Banwell- Fundamentals of molecular spectroscopy,
10.D.M.Willium and I.Fleming - Spectroscopic methods of Inorganic Chemistry,
11.J.Charalambous - Mass spectrometry of metal compounds,
12.J.W.Robbinson- Under graduate Instrumental Analysis,
13.D.A.Skoog,F.J.Holler and Neman-- Instrumental Methods of Analysis.,

PAPER–II ANALYSIS OF DRUGS, FOODS, DAIRY PRODUCTS & BIOCHEMICAL ANALYSIS (C4.2 (A) -10)

UNIT I

Analysis of the following drugs and pharmaceuticals preparations: (Knowledge of molecular formula, structure and analysis)

Analysis of anlgesics and antipyretics like aspirin and paracetamol

Analysis of antimalerials like choloroquine .

Analysis of drugs in the treatment of infections and infestations :Amoxycillin., chloramphenicol, metronidazole, penicillin, tetracycline. Anti tuberculous drug- isoniazid.

UNIT II

Analysis of the following drugs and pharmaceuticals preparations:

(Knowledge of molecular formula, structure and analysis)

Analysis of antihistamine drugs and sedatives like: allegra, zyrtec(citirizine), alprazolam, trazodone, lorazepem.

Analysis of anti epileptic and anti convulsant drugs like phenobarbital and phenacemide.

Analysis of drugs used in case of cardiovascular drugs:atenolol, norvasc(amlodipine),

Analysis of lipitor(atorvastatin) a drug for the preventin of productin of cholesterol.

Analysis of diuretics like: furosemide (Lasix), triamterene

Analysis of prevacid(lansoprazole) a drug used for the prevention of production of acids in stomach.

UNIT III

Analysis of Milk and milk products: Acidity, total solids, fat, total nitrogen, protenines,lactose, phosphate activity, casein, choride Analysis of food materials- Preservatives: Sodium carbonate, sodium benzoate sorbic acid Flavoring agents - Vanilla , diacetyl, isoamyl acetate, limonene, ethylpropionate , allyl hexanoate and Adulterants in rice and wheat, wheat floo0r, sago,coconut oil, coffee powder, tea powder, milk.

UNIT IV

Clinical analysis of blood: Composition of blood,clinical analysis,trace elements in the body. Estimation of blood, chlolesterol,glucose,enzymes,RBC & WBC ,Blood gas analyzer.

SUGGESTED BOOKS:

1. F.J.Welcher-Standard methods of analysis,
2. A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,
3. F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,
4. J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on analytical chemistry and its applications -- Inter Science- Vol I to VII.,
5. Aanalytical Agricultrual Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers.
6. Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi CBS Publishers and Distributors, New Delhi.
7. G.Ingram- Methods of organic elemental micro analysis- Chapman and Hall.,
8. H.Wincciam and Bobbles (Henry J)- Instrumental methods of analysis of food additives.,
9. H.Edward-The Chemical analysis of foods;practical treatise on the examination of food

stuffs and the detection of adulterants,
10. The quantitative analysis of drugs- D.C.Garratt-Chapman & Hall.,
11. A text book of pharmaceutical analysis by K.A.Connors-Wiley-International.,
12. Comprehensive medicinal chemistry-Ed Corwin Hansch Vol 5,Pergamon Press.,

PAPER–III ENVIRONMENTAL CHEMSITRY AND ANALYSIS (C4.3 (A)-10)

UNIT-I

Significance of basic segments of Environment-Nomenclature in the study of Environmental Chemistry.

Soil Chemistry & Polluution Studies:Principles of weathering-effect of temperature, water, air, plants and animals on weathering., Soil formation/development-factors affecting soil development-physical properties of soil; soil colloids-ion exchange proerties.,Soil fertility,productivity- Soil nutrients-micro and macro.

UNIT II

Study of water pollution and monitoring and treatment methods of water pollutants:

Hydrosphere-water resources-hydrological cycle-unique properties of water- water quality parameters.,

Pollution from Domestic water, industrial,agricultural,solid waste, shipping, radioactive waste & thermal pollution , Effect of specific pollutants like mercury, lead, arsenic, selenium, nitrates, oil.,

Effects of soaps,detergents,pesticides,hydrocarbon with regard to water pollution.,

Techniques of water treatment-Primary, secondary and tertiary methods-use of coagulants-flash distillation-solar stills, ion exchange reverse osmosis, electro dialysis.

UNIT -III

Study of air pollution and monitoring and treatment methods in case of airpollution:

Atmospheric sources and emission of air pollutants-carbon monoxide-sulphur, oxides-oxides of nitrogen, organic pollutants and photo chemical smog-particulates-acid rain and radioactive substances.

Continuous monitoring of air pollutants-Principles, Monitoring instruments, monitoring of sulphur dioxide, hydrogen sulphide, oxides of nitrogen, oxides of carbon, hydrocarbons, ozone and suspended particulate matter and radioactive substances.

UNIT-IV

Environmental chemical analysis:

Analysis of soil: Sampling, determination of moisture, total nitrogen, phosphorus, silicon, lime, humus, nitrogen, alkali salts.,

Analysis of water samples: Dissolved oxygen, Chemical oxygen demand, Biological oxygen demand, Phosphates, nitrogen compounds.

Analysis of metallic constituents.

Analysis of Air samples: carbon mono oxide, carbon dioxide, sulphur dioxide, hydrogen sulfide, oxides of nitrogen, ammonia, ozone, hydrocarbons and aromatic hydrocarbons.,

SUGGESTED BOOKS:

1. Environmental Chemsitry by A.K.De, Wiley Eastern Limited, New Delhi
2. A Text Book of Environmental Chemistry by O.D.Tyagia and M.Mehra-Anmol Publicaitons,
3. Environmental Pollution Control and Engineering by C.S.Rao , Wiley Eastern Limited,
4. Environmental Chemistry by P.S.Sindhu,-New Age International Publishers
5. A Text Book of Environmental Chemistry and Poolution Control by S.S.Dara ,S.Chand & Co
6. Environmental Pollution Analysis by S.M.Khopkar, Wiley Eastern Limited, New Delhi
7. Aanalytical Agricultrual Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
8. Mannual of soil, plant, water and fertilizer analysis, R.M.Upadhyay and N.L sharma, Kalyani Publishers, New Delhi
9. Environmental Chemistry by B.K.Sharma- Goel Publishing House, Meerut.
10. Soil Chemical Analysis by M.L.Jsackson,Prentice-Hall India Pvt Ltd, New Delhi

PAPER–IV SEPARATION TECHNIQUES AND ELECTRO ANALYTICAL TECHNIQUES (C4.4 (A)-10)

UNIT-I

Separation techniques in chemical analysis:

Solvent extraction :

Introduction,principle,techniques,factors affecting solvent extraction, quantitative treatment of solvent extraction equilibria-chelate and ion association systems-synergism.,

Ion exchange :

Introduction, action of ion exchange resins, separation of inorganic mixtuers, applications.,

UNIT - II

Chromatography:

Introduction-Column,paper chromatography-Thin layer chromatography and HPLC and Gas chromatography :Introduction, equipment.Gas liquid chromatography. Exclusion chromatography.-Applications

UNIT III

Electrogravimetry :

Theory of electro analysis–Polarisation–Over voltage–Principles involved in electrogravimetric analysis–current – voltage curves – separation of metals by electrolysis – constant current – controlled potential electrolysis.

Coulometry : -

Coulometry at controlled potential – separation of Nickel and Cobalt – coulometres – types of coulometric analysis – constant current coulometry of coulometric titrations.

UNIT – IV:

Voltametry, Polarography and Amperometric titrations: -

Voltametry – Principle of Polarography – dropping mercury electrode; working; factors effecting the limiting current; residual current, migration current – diffusion current – kinetic current – polarographic maximum – Half wave potential – Organic Polarography, Rapid Scan polarography – cyclic voltametry – qualitative and quantitative polarographic analysis – Amperometric titrations – its advantages and disadvantages – Bi Amperometric titrations – Chrono potentiometry

SUGGESTED BOOKS:

1.B.K.Sharma -- Instrumental methods of chemical analysis,Goel Publishers.
2.G.Chatwal and S.Anand --Instrumental methods of chemical analysis.
3.J.J.Lingane- Electroanalytical Chemistry- Inter Science,
4.A.I.Vogel -- A text Book of Quantitative Inorganic Analysis-ELBS.
5.H.H.Willard,LL Merrit and JA Dean -- Instrumental Methods of Analysis.
6.Peace-Instrumental Methods of Analysis.
7.J.W.Robbinson- Under graduate Instrumental Analysis.
8.R.A.Day and A.L.Underwood- Quantitative Analysis.
9.G.W Eving- Instrumental Methods of Chemical Analysis.,
10.D.A.Skoog,D.M.West and F.J.Holler--Fundamentals of Analytical Chemistry.
11.H.Kaur-- Instrumental methods of chemical analysis,Pragathi Prakasan.
12.D.A.Skoog,F.J.Holler and Neman-- Instrumental Methods of Analysis.
13.G.H.Morrison and H.Frieser- Solvent extraction in Analytical Chemistry.
14. Chemical Separation methods- JA Dean, D.Vannostrand Company, New York
15. Physical and Chemical Methods of Separation by E.W.Berg, MC Graw Hill Book, Company, New York

Acharya Nagarjuna University

M sc Final Year Chemistry (Analytical Chemistry Specialization) - IV Semester
Effective for the Students admitted from the year 2014-2015

PRACTICAL-I:

Classical and Instrumental Methods

1. Analysis of Synthetic mixture of Copper and Nickel
2. Estimation of total Iron with different procedure using various reducants
3. Analysis of dissolved oxygen in water samples
4. Estimation of Mn(VII) and V(v) with Fe(II) using potentiometric method
5. Mixture analysis of Ce (IV) and V(v) with Fe(II) by potentiometric method
6. Determination of Carbonate content of a base by grantitration
7. Conductometric determination of strong acid, weak acid and Cu^{2+} in a mixture with strong base.
8. P^H metric titration of carbonate and hydroxide mixture with HCl
9. P^H metric titration of carbonate and bicarbonate mixture with HCl

PRACTICAL-II: Project Work/Home Paper

Project Work / Internship is compulsory for the University students.
Selection of Home Paper/Project Work is optional for affiliated college students.
The students opted for Home Paper must be assigned a latest topic and the students have to submit a dissertation (50-60 pages) covering all the latest literature on the topic assigned. The candidate will be assessed at the time of the conduct of final practical examination of the semester taking into consideration of dissertation and viva-voce on the topic chosen for home paper.