

IX. To consider the minutes of the meeting of the **Board of Studies PG in Chemistry, ANU** held on 08-08-2008 at ANU Campus.

The Board of Studies has passed the following resolutions:-

Item 1.

Review of syllabi for the I and II semesters of M.Sc. Chemistry course for the batch of students to be admitted during the academic year 2009-10

RESOLVED TO RECOMMEND to approve the modified syllabi for all the four papers after careful review and revision as appended through **annexure I** along with model question papers.

Item 2.

Panels of examiners for both paper setting for all the theory papers revised above and for the conduct of practical examinations to M.Sc students previous and final from February, 2009

RESOLVED TO RECOMMEND to approve the Panels of examiners after thorough discussion (**Annexure II**)

Further resolved to authorize the BOS Chairman to take necessary steps for the appointment of examiners for conduct of practical examinations both at University campuses and at affiliated colleges.

It is also resolved to authorize the Chairman to take the services of retired Professors at other Universities to nominate as examiners in case of contingencies.

Also resolved to authorize the Chairman to collect the information from all the affiliated colleges pertaining to the teaching staff appointed through the selection committees appointed by the University authorities under the Chairman ship of Vice-Chancellor or his nominee.

Further resolved that only teachers appointed through the above selection committee possessing M.Phil degree besides three years of PG teaching experience be considered for appointment as one of the examiners for practical examinations.

However, it is also resolved to relax the experience criteria in case of teachers having Ph.D degrees besides retired teachers of University who are at present working in affiliated colleges with the knowledge of University authorities.

Item 3.

Any other item:

Issue of starting of new combinations at B.Sc level with chemistry subject in order to improve the quality of students that are taking up the M.Sc. Chemistry studies.

It is felt necessary to **RESOLVED TO RECOMMEND** to advise the University authorities to consider the inclusion of the following combinations at B.Sc. level in order to train the chemistry

students through computer knowledge such that the M.Sc. chemistry students after completing the M.Sc. course will be competent to face the challenge along with other soft ware professionals in view of the latest developments in research in the health care science including chemistry where molecular modeling and drug designing are occupying the utmost importance.

1. B.Sc. with Mathematics, Chemistry and Computer Science/ applications etc
2. B.Sc. with Physics, Chemistry and Computer Science/ applications etc

(For a copy of course syllabus, panel of paper setters etc., Please see Appendix - IV)

RESOLVED that:

1. Resolution of the BOS on Item No. 1 be implemented from the academic year 2010-11.

2. In case of Resolution of the BOS on Item No. 2, resolved to appoint a Committee with the following to make recommendation as to the procedure to be adopted for appointing examiners for the conduct of practical exams for M.Sc. Chemistry.

- | | | |
|--|---|----------|
| 1. Prof.G.N.Brahmanandam,
Principal, University College, ANU | - | Convener |
| 2. Prof.Lam Prakasha Rao,
Dean, Faculty of Physical Sciences, ANU | - | Member |
| 3. Prof.K.S.Tilak,
Dean, Faculty of Natural Sciences, ANU | - | Member |
| 4. Prof.I.Ramesh Babu,
Member, Executive Council, ANU | - | Member |

3. In case of Resolution of the BOS on Item No. 3, resolved to constitute a Committee with the following to make recommendations on the restructuring of combinations in Sciences at UG level.

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|--|---|----------|
| 1. Prof.Y.P.Ramasubbaiah,
Dean, CDC, ANU | - | Convener |
| 2. Prof.Lam Prakasha Rao,
Dean, Faculty of Physical Sciences, ANU | - | Member |
| 3. Prof.K.S.Tilak,
Dean, Faculty of Natural Sciences, ANU | - | Member |
| 4. Chairmen, BOS in UG, ANU
(in all Science subjects) | - | Members |

Acharya Nagarjuna University Syllabus for M.Sc., Chemistry(PREVIOUS)
FROM THE YEAR 2009-2010
SEMESTER – I (CH 101-09)
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 computation rules - 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-Displacement titrations-Precipitation titrations-Indicators for precipitation titrations-Volhard method-Mohr method-Theory of adsorption indicators-Oxidation reduction 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 I-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 $1+x+x^2 +x^3 + \dots x^n$

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 equation.

iv) Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic Weak acid.

v) Standard deviation and variance of univariate 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.

UNIT-I

Acharya Nagarjuna University: **Syllabus for M.Sc., Chemistry (PREVIOUS)**
FROM THE YEAR 2009-2010
SEMESTER – I (CH 102-09)
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 momenta .

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 - $p\pi$ - $d\pi$ 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 H_2) and bent (H_2O) molecules . Molecular Orbital theory , Symmetry of Molecular orbitals , Molecular orbitals in triatomic (Be H_2) molecules and ions (NO_2^-) 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 Δ_o . 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 correlations - Irving – William's series . Hard and soft acids and 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. Affiliated 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 .

ACHARYA NAGARJUNA UNIVERSITY
SYLLABUS FOR M.SC., CHEMISTRY (PREVIOUS)
FROM THE YEAR 2009-2010
SEMESTER – I (103-09)
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 benzenoid aromatic compounds:-cyclopropenyl cation, Cyclobutadienyldication, cyclopentadienyl anion-tropyllium cation and cyclo octatetraenyl dianion.
 - Metallocenes, Ferrocene, Azulenes, Fulvenes, Annulenes, Fullerenes.
 - Homo aromaticity, Anti aromaticity and pseudo (Ψ) aromaticity,.

UNIT – II

REACTIVE INTERMEDIATES AND HETEROCYCLIC COMPOUNDS:

- a) **Reactive Intermediates:-** Generation, Structure, Stability and reactivity of Carbocations, Carbanions, free radicals, Carbenes, nitrenes and Benzene.
- b) **Heterocyclic Chemistry:-** Synthesis and Reactions 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 nomenclature, diastereoisomerism; Interconversion of Fischer, Newman and Sawhorse projections. Threo and Erythro isomers, methods of resolution, stereo specific 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 cyclohexanes, energy profile diagram – Mono and di- substituted cyclohexanes – conformations and physical properties. Effect of conformation on reactivity in mono and di-substituted cyclohexane derivatives.
- c) Elementary treatment of fused and bridged ring systems – Decalines and Bornanes. Conformation of sugars, steric strain due to unavoidable crowding.

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. Basic Principles of Organic Chemistry by J. B. Roberts and M. Caserio.
13. Stereo Chemistry of Organic compounds, P. S. Kalsi, New Age International.

Acharya Nagarjuna University
Syllabus for M.Sc., Chemistry (PREVIOUS)
FROM THE YEAR 2009-2010
SEMESTER – I (104-09)

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-Helmholtz equation - Maxwell partial relations - Conditions of equilibrium and spontaneity - Free energy changes in chemical reactions: Van't Hoff reaction isotherm - Van't Hoff equation - Clausius 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 fluorescence and Auger 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 - Measurement of EMF - Nernst equation - Equilibrium constant from EMF Data - pH and EMF data - concentration 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 - Anomalous behaviour of strong electrolytes. Debye Huckel-Onsager 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 - Hammett - Taft equation - Chain reactions - Rate laws of H_2-Br_2 , photochemical reaction of $H_2 - Cl_2$ 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.

Acharya Nagarjuna University
Syllabus for M.Sc., Chemistry (PREVIOUS)
FROM THE YEAR 2009-2010
SEMESTER – II (CH 201-09)
PAPER – I, GENERAL CHEMISTRY 60Hrs.(4Hrs./Week)

UNIT-1

Symmetry and Group theory in Chemistry - Symmetry elements, symmetry operation, definition of group, sub group, relation between order of a finite group and its sub group. Point symmetry group. Schoenflies symbols, representation of groups by Matrices (representation for the C_n , C_{nv} , C_{nh} , D_n etc. groups to be worked out, explicitly). 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 frequencies, Intensities non-rigid rotator-Microwave spectra of polyatomic molecules.

Infrared spectroscopy

Harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths, anharmonicity Morse potential energy diagram. Vibration – rotation spectroscopy. PQR branches, 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 anti-stokes 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, deshielding, spin – spin interactions, factors influencing, coupling constant J. Classification (ABX, AMX, ABC, A_2 , B_2 etc.) Basic ideas about instrument NMR studies of nuclei other than proton – ^{13}C , ^{19}F , ^{31}P . Use of NMR in medical diagnostics.

Electron spin resonance spectroscopy. :-

Basic principles, zero field splitting and Kramers's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin hamiltonian, 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.

ACHARYA NAGARJUNA UNIVERSITY
SYLLABUS FOR M.Sc ; CHEMISTRY (PREVIOUS)
SEMESTER - II (CH 102-09) FROM THE YEAR 2009 – 2010)

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 lobar relation ships , electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in dinuclear [Re₂Cl₈]²⁻ ion, trinuclear [Re₃Cl₉] , tetra nuclear W₄OR₁₆, hexa nuclear [Mo₆Cl₈]⁴⁺ and [Nb₆Cl₁₂]²⁺ , poly atomic Zintl ions and Chevrel phases. Applications of clusters

Metal π- complexes: preparation, structure 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 ($\eta^4 - \eta^8$) 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 metal-ligand 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 d^1 to d^9 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. Addison, W. R. Cullen, D. Dolphin and G. J. James. Wiley Interscience.
9. Photochemistry of coordination compounds, V. Balzani and V. Carassiti. Academic Press
10. Text book of Coordination chemistry by K. Soma Sekhar Rao and K.N.K. Vani, Kalyani Publishers .

ACHARYA NAGARJUNA UNIVERSITY
SYLLABUS FOR M.SC., CHEMISTRY (PREVIOUS)
FROM THE YEAR 2009-2010
SEMESTER – II (203-09)
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, Clasién, 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 π and σ bonds, anchimeric assistance.

b) Aromatic Nucleophilic substitution:

The SN^{Ar}, SN¹ mechanisms and benzyne mechanism. Reactivity- effect of substrate structure, leaving group and attacking nucleophile. The Von-Richter, 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 Terpenoids:** General methods of identification of terpenoids, Isoprene rule, biogenetic isoprene rule and classification of terpenes. Structural elucidation and synthesis of α - 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. Naturally occurring quinines – R. H. Johnson Vol. I & II, Academic Press, London.

Acharya Nagarjuna University
Syllabus for M.Sc., Chemistry (PREVIOUS)
FROM THE YEAR 2009-2010
SEMESTER –II (CH 204-09)
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-Planck 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 - Chemiluminescence-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 Science, 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 Rohatgi-Mukherjee. Wiley Eastern Ltd publications.
13. Statistical Thermodynamics-M.Dole

M.Sc. Previous Practical (I and II Semesters)
Inorganic Chemistry
Practical - I

I. Preparation of some complex compounds:

- a) Potassium trisoxalate ferrate (III)
- b) Mercury tetrathiocyanate cobalate (II)
- c) Tris thiourea copper (I) sulphate
- d) Cis and trans potassium diaquo dioxalato chromium (III)
- e) Hexa ammine cobalt (III) chloride
- f) Nitro and Nitrite pentaammine Cobalt III chloride
(Minimum four Preparation)

II. Qualitative Analysis:

Semimicro analysis of six radical mixtures containing one interfering radical and one less familiar cation each,

Interfering anions : Oxalate, tartrate, phosphate, chromate.
Less familiar Cations : Thallium, molybdenum, thorium,
zirconium, vanadium, uranium.
(Minimum three Mixtures)

III Quantitative analysis:

- a) Determination of Zn^{2+} with potassium ferrocyanide (Volumetric)
- b) Complexometric titrations: Determination of Mg^{2+} , Ni^{2+} and hardness of water using EDTA.
- c) Determination of Fe^{3+} by photochemical reduction.
- d) Argentometry: Determination of chloride by argentometric titration using a) K_2CrO_4 (b) Fluorescein as indicators.
- e) Determination of nickel using dimethyl glyoxime, "Copper using ammonium thioyanate, Zn using di ammonium hydrogen phosphate – gravimetrically
(Minimum two Gravimetric experiment)

IV Chromatography.

Separation of cation and anion by paper chromatography.
(at least one experiment)

BOOKS SUGGESTED

1. Vogel's Text Books of Qualitative analysis, Revised. J. Vogel, R.C. Denny, G.H. Jeffery and J. Mendham. ELBS.
2. Vogel's Text Book of Quantitative analysis, revised. J. Bassett, R.C. Denny, G.H. Jeffery and J. Mendham, ELBS.
3. Synthesis and Characterisation of Inorganic Compounds, W.L. Jolly. Prentice Hall.
4. Practical Inorganic chemistry by G. Pass and H. Sutcliffe Chapman and Hall.
5. Practical Inorganic Chemistry by. K. Somasekhar Rao and K.N.K. Vani.

M.Sc., CHEMISTRY (PREVIOUS) PRACTICAL II

Organic Chemistry

1. Identification organic compounds:

Phenol, base, organic acid, ketone, aldehyde, amide and carbohydrate with preparation of two solid derivatives.

2. Preparations:

i). Iodoform

ii) n-Dinitroderivative

iii) Aspirin

iv) p-Nitroaniline

v) Benzophenone

vi) Benzoic acid

vii) p-Bromo Acetanilide

viii) Acetanilide

1. Identification of given two compounds with preparation of two solid derivatives and reporting of the melting points for derivatives
2. One preparation – Yield of crude and crystallized sampled and reporting of the melting point.

M.Sc., CHEMISTRY (PREVIOUS) PRACTICAL - III

Physical Chemistry Practicals :

1. Determination of rate constant of the oxidation of iodide ion with persulphate ion.
2. Relative strengths of acids by studying the hydrolysis of ethylacetate / methyl acetate
3. Determination of equilibrium constant of $KI_3 \leftrightarrow KI + I_2$ by partition coefficient method and determination of unknown concentration of potassium iodide.
4. Distribution coefficient of Benzoic acid between Benzene and water.
5. Determination of critical solution temperature of phenol-water system Study of the effect of electrolyte on the miscibility of phenol-water system
6. Potentiometric determination of Fe(II) with Cr (VI)
7. Potentiometric titration of chloride with silver nitrate.
8. pH-metric determination of strong acid with strong base.
9. Conductometric titration of strong acid with strong base

10. Verification of Beers Law using potassium permanganate/Potassium dichromate.
11. Determination of formulae and stability constant of a metal complex by spectrophotometric method.
- 12 Verification of Langmuir isotherm . Determination of unknown concentration of acetic acid by studying its adsorption on activated charcoal.