ACHARYA NAGARJUNA UNIVERSITY

M.Sc. FIRST YEAR CHEMISTRY

Effective for the students admitted from the year 2021-2022

SEMESTER – I

Paper-I: Foundation for Chemistry (CH101T)

Marks: 70

Learning Objectives:

- ✓ To know the fundamentals in analytical & inorganic estimations.
- ✓ To know the possible intermediates formed during course of chemical reactions.
- ✓ To know the type of bonding in organic molecules.
- ✓ To know about molecular symmetry, molecular representations and their applicational aspects.

UNIT-I **10H**

Titrimetric analysis: Acid-base titrations, redox titrations, complexometric titrations, precipation titrations-principle, example and corresponding indicators, Pri., Sec.-standards.

UNIT-II **10H**

Treatment of analytical data: Errors, classification, accuracy, precision, SD, MD, Student-T test F-test, Gassian distributation

UNIT-III **14H**

Reactive Intermediates: Generation, Structure, Stability and reactivity of Carbocations, Carbanions, free radicals, Carbenes, nitrenes and Benzyne; Electrophiles, Nucleophiles, Catalysts-definition and examples.

Nature of bonding in organic molecules: Localised and Delocalized covalent bonds, Delocalised chemical bonding conjugation, cross conjugation, hyper conjugation, tautomerism.

UNIT-IV **14H**

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-V **12H**

Environmental chemistry:

Classification of environmental segments, types of pollutions, acid rains, Global warming

Chemistry of Biomolecules: Definition, functional uses and examples for Carbohydrates, lipids (fats and oils), enzymes. Chemistry of purines and pyrimidines, Nucleic acids - Structure and functions of DNA & RNA.

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).

Learning Outcomes:

- ✓ The student will understand the required tools in analytical and inorganic estimations.
- ✓ Understanding of various types of reaction intermediates and the bonding present in various organic compounds.
- ✓ Students are able to understand the basics on various environmental concerns.
- ✓ Students know about types of various biomolecules and their functions with reference to structure.

ACHARYA NAGARJUNA UNIVERSITY
M.Sc. FIRST YEAR CHEMISTRY
Effective for the students admitted from the year 2021-2022
SEMESTER – I
PAPER–II: INORGANIC CHEMISTRY (CH102T)

Marks: 70

Learning Objectives:

- ✓ To know the fundamentals in VSEPR theory.
- ✓ To know the Crystal field theory.
- ✓ To know the Molecular Orbital Theory.
- ✓ To know the Hard and Soft Acids and Bases and Macro Cyclic complexes.
- ✓ To know the higher boranes, Isopoly and heteropoly anions.

UNIT-I **12H**

Structure and Bonding: VSEPR theory and its role in explaining the structures of inorganic molecules. Walsh diagrams for linear molecule (Be H_2) and bent molecule (H_2O). Molecular Orbital theory - Symmetry of Molecular orbitals, Molecular orbitals in triatomic (Be H_2) molecules and ions (NO_2^-) and energy level diagrams.

Participation of p and d orbitals in pπ - dπ bonding- Evidences from both non transition and transition metal compounds.

Non-valence cohesive forces, Hydrogen bonding - Symmetric and unsymmetric hydrogen bonds in inorganic molecules.

UNIT II **12H**

Metal-Ligand Bonding: Crystal Field Theory of bonding in transition metal complexes Splitting of d-orbitals in Octahedral, tetrahedral, trigonal bipyramidal and Square pyramidal fields and energy orders of orbitals.

Tetragonal distortions - Jahn Teller effect. Static and dynamic Jahn -Teller effects. Chelates and Jahn - Teller effect

Spectrochemical series. Nephelauxetic effect. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies. Applications and limitations of CFT.

UNIT III **12H**

Molecular Orbital Theory - Evidence for covalence in complexes - Experimental evidences from both σ and π bonded complexes.

Molecular 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 .

MOT and Resonance. Resonance in homoatomic molecules (H_2) and hetero atomic ions.

Molecular Orbital Theory and Hybridization. Bents Rule and energetic of Hybridization.

UNIT IV **12H**

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 method) and Limitations to Jobs method. Determination of formation constants by pH metric method (Bjerrum's method).

Stability correlations and Irwing -William's series for transition metal ions.

Hard and soft acids and bases (HSAB) – Acid-base strength and HSAB , Electro negetivity and HSAB.

Macrocyclic complexes - Crown ethers and Cryptates.

UNIT V **12H**

Non Metal Cages and Ring Compounds: Preparation and structures of higher boranes, Electron counting rules in boranes – Wades rules and Polyhedral skeletal electron pair theory. Heterocyclic inorganic ring systems Boron-Nitrogen (B-N), Phosphorus–Nitrogen (P-N) and Sulphur-Nitrogen (S-N) cyclic compounds.

Cage compounds of Phosphorous-Oxygen (P-O) and Phosphorous-Sulphur (P-S).

Preparation and structures of Isopoly and heteropoly anions and their sats.

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.
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) Concise Coordination Chemistry, R.Gopalan and V.Ramalingam.

Learning Outcomes:

- ✓ The student will understand the VSPER theory, symmetric and unsymmetric Hydrogen bonds in inorganic molecules.
- ✓ Understanding the Crystal field theory and Jahn Teller Effects.
- ✓ The Students are able to understand the basics of molecular orbital theory and energetic of hybridization.
- ✓ The Students are able to understand the Jobs method, hard and soft acids and bases.
- ✓ The Students are able to understand the study of age compounds of oxygen, phosphorous and sulphar compounds and also isopoly and heteropoly anions.

ACHARYA NAGARJUNA UNIVERSITY

M.Sc. FIRST YEAR CHEMISTRY

Effective for the students admitted from the year 2021-2022

SEMESTER – I

Paper-III: Organic Chemistry (CH103T)

Marks: 70

Learning Objectives:

- ✓ To Know about Aromaticity in Benenoid compounds and Non-Benzenoid compounds.
- ✓ To know about basics on heterocyclic compounds, their synthesis and importance.
- ✓ To know the importance of natural products, their medicinal use.
- ✓ To know particularly about terpenoids and their classification and synthesis.
- ✓ To discuss stereochemistry more elaborately.
- ✓ To know about the conformations of acyclic, monocyclic and fused ring systems.

UNIT-I **12H**

Aromaticity Benzenoid & Non-Benzenoid: Concept of aromaticity, Huckel's rule for aromaticity in benzenoid compounds, Aromaticity of five membered, six membered rings and fused systems.

***Non benzonoid aromatic compounds*:** Cyclopropenyl cation, Cyclobutadienyl dication, cyclopentadienyl anion, tropyllium cation and cyclooctatetraenyl dianion. Ferrocene. Azulenes, Fulvenes, Annulenes, Fullerenes. Homo aromaticity, and Anti aromaticity.

UNIT-II **12H**

Heterocyclic Compounds and Natural Products:

a) Synthesis, Properties and Reactions of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole; Skraup synthesis, Fisher indole synthesis.
b) Heterocyclic compounds more than one hetero atom- synthesis, properties and reaction of Pyrazole, Imidazole, Oxazole Iso-Oxazole, Thiazole.

Natural Products: Importance of natural products as drugs.

Terpenoids: General methods in the structure determination of terpenes. Isoprene rule. Structure determination and synthesis of α-terpeniol, β-carotene, and camphor.

UNIT-III **12H**

Stereochemistry

a) *Molecular representations of organic molecules* –Wedge, Fischer, Newman and Saw-horse formulae, their description and inter-conservation. Stereoisomerism-Definition, classification.
b) *Concept of Chirality and Molecular Symmetry*: Symmetry operations, Recognition of symmetry elements (Cn, Ci and Sn), Dissymmetric and asymmetric molecules. Chiral structures (one and more than one chiral centers); D-L and R–S nomenciature, diastereoisomerism; Threo and Erythro isomers, Racemic mixture, racemization and methods of resolution, stereo specific and stereoselective synthesis. Stereochemistry of compounds containing nitrogen, sulphur and phosphorous.

c) **Geometrical isomerism**– E,Z- nomenclature –Spectral and chemical methods of determining the configuration of geometrical isomers. Determination of configuration in aldoximes and ketoximes.

UNIT-IV **12H**

Conformational Analysis-I

a) *Conformation of acyclic molecules* –alkanes and substituted alkanes (Ethane and 1,2-disubstituted ethane derivatives like butane, dihalobutane halohydrin, ethylene glycol, butane-2,3-diol, amino alcohols and 1,1,2,2-tetrahalobutanes). Klyne-Prelog terminology for conformers and torsion angles.

b) Factors affecting the conformational stability and conformation equilibrium-Attractive and Repulsive interactrions. Use of Physical and Spectral methods in conformational analysis.

c) Conformational effects on the stability and reactivity of diastereomers in cyclic molecules-steric and stereo electronic factors-examples.

UNIT-V **12H**

Conformational Analysis-II

a) *Conformations of monocyclic compounds*–cyclohexane -chair, boat and twist boat cyclohexanes, energy profile diagram –mono- and di- substituted cyclohexanes– conformations. Effect of conformation on stability and reactivity in mono and disubstituted cyclohexane derivatives.

b) *Conformations of unsaturated acyclic compounds*: Propylene, and 1-Butene

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 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 pubs.

Learning Outcomes:

- ✓ Students can able to understand aromaticity in Benenoid compounds and Non-Benzenoid compounds.
- ✓ Students are able to understand formation of various heterocyclic compounds and their synthesis and importance.
- ✓ Students can understand the importance of natural products in medicinal chemistry
- ✓ Students can able to write the stereo chemical forms for different organic molecules.
- ✓ Understand the conformations of acyclic, monocyclic and fused ring systems and applying it to organic compounds.

ACHARYA NAGARJUNA UNIVERSITY
M.Sc. FIRST YEAR CHEMISTRY
Effective for the students admitted from the year 2021-2022
SEMESTER-I
PAPER-IV: Physical Chemistry (CH104T)

Marks: 70

Learning Objectives:

- ✓ To know the first and second law of thermo dynamics.
- ✓ To know the surface tension, Gibbs-Adsorption, X- ray flouresence and Augar electron spectroscopy.
- ✓ To know the micelles - Hydrophobic interaction.
- ✓ To know the Nernst equation and Debye Huckel - Onsagar equation.
- ✓ To know the complex reactions, Collision theory and chain reactions.

UNIT-I **12H**

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 equation - 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 - GibbsDuhem equation - partial molar volume - determination of partial molar quantities - Fugacity - Determination of fugacity - Thermodynamic derivation of Raoult's law.

UNIT II **12H**

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.

UNIT III **12H**

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-IV **12H**

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 - Anamolous behaviour of strong electrolytes. Debye Huckel-Onsagar equation - verification and limitations - Bjerrum treatment of electrolytes - conductometric titrations.

UNIT-V **12H**

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 H_2-Br_2, photochemical reaction of H2 - Cl2 Decomposition of acetaldehyde and ethane - Rice-Hertzfeld mechanism.

Reference Books:

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 Chemistry, W.J. Moore, Prentice Hall
8) Atomic structure and chemical bond. Manas Chanda. Tata McGraw Hill Company Limited.

Learning Outcomes:

- ✓ Students can able to understand the classical thermo dynamics, fugacity.
- ✓ Students are able to understand Kelvin equation, Gibbs-Adsorption equation - BET equation.
- ✓ Students are able to understand the Classification of surface active agents.
- ✓ Students are able to understand the Electrochemical cells, Liquid junction potential.
- ✓ Understand the complex reactions, chain reactions.

Course: M.Sc.; Specializations: Analytical, Inorganic, and OrganicChemistry

Practical Syllabus (Semester: I; Batch: 2021-22)

Practical – I: Inorganic Chemistry

(Minimum five experiments must be carryout) Max. Marks: 53 (43Prac. & 5Viva + 5Rec.)

Quantitative Analysis

List of Experimetns:

1) Determination of Zn2+ with potassium ferrocyanide (Volumetric).
2) Complexomatric titrations: Determination of Mg 2+, Ni2+ and hardness of water using EDTA.
3) Determination of Fe3+ by photochemical reduction.
4) Argentometry: Determination of chloride by argent metric titration using.
   a) K2CrO4 (b) Fluorescein as indicators.
5) Determination of nickel using dimethyl glyoxime.
6) "Cupper using ammonium thiocyanate".
7) Zn using di ammonium hydrogen phosphate – gravimetrically.
   (Minimum two Gravimetric experiments).

Reference Books:

1) Vogels Text Books of Quantitative analysis, Revised. J. asset, R.C. Denny, G.H. Jeffery and J. Mendhan. ELBS.
2) Synthesis and Characterisation of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3) Practical Inorganic chemistry by G. Pass and H. Sutcliffe Chapman and Hall.
4) Practicle Inorganic Chemistry by. K. Somasekhar Rao and K.N.K. Vani.

Course: M.Sc.; Specializations: Analytical, Inorganic, and OrganicChemistry

Practical Syllabus (Semester: I; Batch: 2021-22)

PRACTICAL-II: Organic Chemistry

(Minimum five experiments must be carryout) Max. Marks: 53 (43Prac. & 5Viva + 5Rec.)

List of Experiments:

1) One step & Two step Organic compounds preparation – Yield of crude and crystallized samples and reporting of the melting point/Boiling points.
   Preparations: i) Iodoform ii) n-Dinitroderivative iii) Asprin iv) p-Nitroaniline v) Bezophenone vi) Benzoic acid vii) p-Bromo Acetanilide viii) Acetanilide ix) any other organic compound.
2) Purification of organic compound- The student has to do Recryastallization to final compound(s) (for both steps) and submit the sample.
3) Distillation of Alcohol, Toluene.
4) Chromatography- The student has to submit purity of the final product with TLC
5) Chromatographic separation of impurities by TLC.
6) Student should practice solvent extraction methods.

Course: M.Sc.; Specializations: Analytical, Inorganic, and OrganicChemistry
Practical Syllabus (Semester: I; Batch: 2021-22)

Practical – III: Physical Chemistry

(Minimum five experiments must be carryout) Max. Marks: 53 (43Prac. & 5Viva + 5Rec.)

List of Experimetns:

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 KI3 $\leftrightarrow$ KI + I2 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 eletrolyteon the miscibility of phenol-water system.

ACHARYA NAGARJUNA UNIVERSITY

M.Sc. FIRST YEAR CHEMISTRY

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SEMESTER – II

Paper-I: Essential Lab Techniques for Industry (CH201T)

Marks: 70

Learning Objectives:

- ✓ To know the fundamentals in separation analysis using various chromatographic techniques.
- ✓ To know the techniques involving reliable separation by HPLC & GC instrumental techniques.
- ✓ To know the purification by ion exchange chromatography.
- ✓ To know the instrumentation and applications of AAS & ICP-OES.
- ✓ To know the basic principles, instrumentation and advantages UV, IR, NMR, ESR, TEM, SEM- techniques in structural analysis.

UNIT-I **14H**

Chromatography – Adsorption and Partition

1) **Introduction to Chromatography.** Different types of Chromatography. Adsorption chromatography- adsorbents, solvents, solutes, apparatus. Column Chromatography- stationary phase, Mobile phase, packing of column, advantages and disadvantages.
2) **Thin Layer Chromatography:** Basic Principles. Common stationary phases, Methods of preparing TLC plates, Selection of mobile phase, Development of TLC plates, Visualization methods, R_f value. Application of TLC in monitoring organic reactions.
3) **Paper Chromatography:** Basic Principles. Ascending and descending types. Selection of mobile phase, Development of chromatograms, Visualization methods. Application of paper chromatography in the identification of sugars and amino acids. One and two dimensional paper paper chromatography.

UNIT-II **14H**

High Performance liquid chromatography (HPLC): Basic Principles. Normal and reversed Phases. Selection of column and mobile phase. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative estimation of organic compounds. Concepts on HPLC method development.

UNIT-III **12H**

Gas Chromatography: Basic Principles. Different types of GC techniques. Selection of columns and carrier gases. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative analysis of organic compounds.

Ion Exchange Chromatography: Basic Principles. Preparation of cross linked polystyrene resins. Different types of cation and anoin exchange resins. Application in the purification of carboxylic acids and amines.

UNIT-IV **10H**

AAS: Principle, instrumentation and applications

ICP-OES: Principle, instrumentation, applications and advantages over AAS.

UNIT-V **10H**

UV, IR, NMR, ESR, TEM, SEM-Basic principles, instrumentation and advantages.

Reference Books:

1) Principles of Instrumental Analysis by D. A. Skoog, F. J. Holler and T. A. Nieman, Harcourt College Pub.
2) Separation Techniques by M. N. Sastri, Himalaya Publishing House (HPH), Mumbai.
3) Bio Physical Chemistry by A. Upadhyay, K. Upadhyay and N. Nath, (HPH) , Mumbai.
4) A Hand Book of Instrumental Techniques for Analytical Chemistry- Ed-F. A. Settle, Prearson Edn.,
5) Delhi. Introduction to Organic Laboratory Techniques-D. L. Pavia, G. M. Lampman, G. S. Kriz and R. G. Engel, Saunders College Pub. (NY).
6) Instrumental methods of Chemical Analysis by B. K. Sharma, Goel Publish House, Meerut.
7) Instrumental methods of Chemical Analysis by H. Kaur, Pragati Prakasan, Meerut.

Learning Outcomes:

- ✓ The student will understand advantage of cheromatographic separation and application on various reactions.
- ✓ The student will understand the advantage of HPLC & GC techniques over conventional separation techniques.
- ✓ The student will know the exchange of ions taking place in ion exchange chromatography.
- ✓ The student will know the procedure of analysing the elements using AAS & ICP-OES.
- ✓ The students understand the working principles and advantages of the UV, IR, NMR, ESR, TEM, SEM- techniques.

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M.Sc. FIRST YEAR CHEMISTRY
Effective for the students admitted from the year 2021-2022
SEMESTER – II
PAPER-II: INORGANIC CHEMISTRY (CH202T)

Marks: 70

Learning Objectives:

- ✓ To know the Classification and Applications of Metal Clusters.
- ✓ To know the reactions of organo metallic compounds.
- ✓ To know the Anation Reactions and Trans effects.
- ✓ To know the Selection rules, Correlation diagrams and Orgel diagrams.
- ✓ To know the Cotton effect and Faraday effect, structures of Hemoglobin and Myoglobin, Vitamin B_{12}, Photo Chemical Laws.

UNIT-I **12H**

Metal Clusters Classification: LNCs and HNCs**,** Isoelectronic and Iso lobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; Preparation, structure and bonding in di nuclear $[Re_2Cl_8]^{2-}$, tri nuclear $[Re_3Cl_9]$, tetra nuclear $[W_4OR_{16}]$ and hexa nuclear $[Mo_6Cl_8]^{4+}$, $[Nb_6Cl_{12}]^{2+}$ cluster molecules and ions.

Poly atomic Zintle ions and Chevrel phases. Applications of clusters

Metal π-Complexes Preparation, structure and bonding in Nitrosyl, Dinitrogen and Dioxygen complexes.

UNIT II **12H**

Organometallic Complexes of Transition Metals: Classification and electron counting rules. Metallocenes with four, five, six, seven and eight (η^4 - η^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, Hydroformylation and polymerization of olefin using Zeigler- Nutta catalyst.

UNIT III **12H**

Reaction Mechanism in 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.

UNIT IV **12H**

Electronic Spectra of Transition Metal Complexes: Electronic configurations of metal ions and Spectroscopic terms. Selection rules, Breakdown of selection rules, Slator – Condon repulsion parameters, Racah parameters, Term separation energies for d^n electronic configurations.

Correlation diagrams and Orgel diagrams. Tanabe-Sugano diagrams for configurations from d^1 to d^9 octahedral and tetrahedral transition metal complexes of 3d series.

Calculations of Dq, B and β parameters. Charge transfer spectra.

UNIT V **12H**

Magnetic Properties of Transition Complexes: Types of magnetism, anomalous magnetic moments - Orbital and spin contribution, spin - orbit coupling and magnetic moments. Chiroptical properties, Cotton effect and Faraday effect.

Biochemical aspects of iron and cobalt: Binding, storage and transport of dioxygen by Hemoglobin and Myoglobin, Vitamin B_{12} and its importance.

Photo Inorganic Chemistry: Introduction, Photochemical laws, photo redox reactions and photo anation reactions. Photo chemical decomposition of water.

Reference Books:

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.

Learning Outcomes:

- ✓ The student will understand the various metal clusters and metal **π** complexes.
- ✓ Understanding the reactions of organo metallic compounds and its applications.
- ✓ The Students are able to understanding the reaction mechanism in transition metal complexes, anation reactions, and complementary reactions.
- ✓ The Students are able to understand the orgel diagrams and electronic spectra of transition metal complexes.
- ✓ The study of magnetic properties and anamolous magnetic moments of transition complexes.
- ✓ The Students are able to understanding structure and functions of hemoglobin, myoglobin and vitamin B12, photochemical laws.

ACHARYA NAGARJUNA UNIVERSITY

M.Sc. FIRST YEAR CHEMISTRY

Effective for the students admitted from the year 2021-2022

SEMESTER – II

Paper-III: Organic Chemistry (CH203T)

Marks: 70

Learning Objectives:

- ✓ To know the general methods of synthesis involving carbon-carbon multiple bonds
- ✓ To know various mechanisms involved in aliphatic and aromatic Nucleophilic/electrophilic substitution reactions
- ✓ To know about various elimination mechanisms in different types of substrates
- ✓ To know the importance of functional group protection in organic synthesis
- ✓ To know the mechanisms involved in various types of named reactions and their applications in organic synthesis.

UNIT-I **12H**

General Methods for synthesis: Addition reactions involving electrophiles (Br_2, HBr, HOBr, and H_2O/H_2SO_4); nucleophilic additions (Michael addition, Mannich, and Grignard reactions); Addition to C-C multiple bonds -stereo chemistry of addition, formation and reactions of epoxides, syn and anti hydroxylation; hydrogenation (catalytic and Non catalytic).

UNIT-II **12H**

Aliphatic Nucleophilic substitutions: The SN_2, and SN_1: Mechanisms, energy profile diagram and stereochemistry; SNi, mixed SN_1 & SN_2, and SET mechanisms; Factors influencing nucleophilic substitution reactions: Effect of structure, nucleophile, solvent, and leaving group.
The neighbouring group mechanism: Neighbouring group participation by O, N, S, halogens, in nucleophilic substitution reactions. Concept of classical and Non-classical carbocations-Participation of Pi and Sigma bonds as neighbouring groups. Anchimeric assistance-steric requirement.

UNIT-III **12H**

Aromatic Nucleophilic Substitutions: 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.

Aromatic Electrophillic Substitution reactions -Friedel Crafts Alkylation, Acylation, Halogenations.

UNIT-IV **12H**

Elimination and Protecting Groups:

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) **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-V **12H**

Familiar Named Reactions: Benzoin, Perkin, Cannizaro, Dieckmann and Stobbe condensations; Hofmann, Schmidt, Lossen, Curtius, Clasien, Backmann and Fries rearrangements; Reformatsky, Favoursky, Wittig reaction, Baeyer Villiger reaction and Chichibabin reaction, Oppenaur oxidation, Clemmensen, Wolff-Kishner, Meerwein–Ponndorf–Veriey and Birch reductions.

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 organic chemistry, S.M.Mukherji and S.P.Singh, Macmillan.

Learning Outcomes:

- ✓ Students understand the mode of addition reactions involving addition by electrophile and nucleophiles over unsaturated bonds between carbons
- ✓ Students understand and apply the substitution and elimination reaction mechanisms at aliphatic and aromatic substrates for various reactions leading to research
- ✓ Understand how to protect various functional groups in organic synthesis and can apply the same to novel molecules useful for research also.
- ✓ Students understand the mechanisms of studied named reactions and their applications in organic synthesis.

ACHARYA NAGARJUNA UNIVERSITY
M.Sc. FIRST YEAR CHEMISTRY
Effective for the students admitted from the year 2021-2022
SEMESTER-II
PAPER-IV: Physical Chemistry (CH204T)

Marks: 70

Learning Objectives:

- ✓ To know the Third law and Statistical thermodynamics and Nernst Heat theorem, Entropy and probability.
- ✓ To know the classification of polymers, molecular weights determination.
- ✓ To know the Butler-Volmer equation, polarography and Amperometric titrations.
- ✓ To know the Hydrogen-oxygen reaction, Quantum yield and Stern - Volmer equation.
- ✓ To know the hydrolysis of ATP, thermodynamics of biopolymer solutions.

UNIT-I **12H**

Thermodynamics II: Third law and Statistical thermodynamics-Nernst Heat theorem - Third law of thermodynamics - Its limitations - Determination of absolute entropy - concept of districution - 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 **12H**

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 **12H**

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 **12H**

Chemical Kinetics: Branching Chain Reactions - Hydrogen-oxygen reaction - lower and upper explosion limits - Fast reactions - Study of kinetics by flow methods - Relaxation methods - Flash photolysis - Acid base catalysis - protolytic and prototropic mechanism - Enzyme catalysis.

Photo Chemistry: 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.

UNIT-V **12H**

Biophysical Chemistry: Standard free energy change in biochemical reactions, exergonic and endergonic reactions, hydrolysis of ATP, thermodynamics of biopolymer solutions, chain configuration of bio polymers, calculation of average dimensions. Membrane equilibrium, ion transport through cell membrance, dialosis and its function. Structure and functions of proteins, enzymes, DNA and RNA in living systems, forces involved in bio polymer interactions, electrostatic forces, hydrophobic forces, molecular expansion and dispersion forces.

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 Limited Publications.
13) Statistical Thermodynamics - M.Dole.
14) M.N. Hughes, The Inorganic chemistry of Biological Processes, John Wiley and Sons, New York 2nd Edition, 1981.
15) A text book of Biochemistry, AV.S.S. Rama Rao.
16) Physical Chemistry by Atkenes.

Learning Outcomes:

- ✓ Students understand the Third law of thermodynamics, Maxwell-Boltzmann distribution law and Sackur - Tetrode equation.
- ✓ Students understand the Free radical, ionic and Zeigler -Natta Polymerisation.
- ✓ Students understand the Butler - Volmer equation and Ilkovic equation.
- ✓ Students understand the Branching Chain Reactions, Enzyme catalysis and Photochemical equilibrium.
- ✓ Students understand the free energy change in biochemical reactions, exergonic and endergonic reactions, DNA and RNA in living systems in biopolymer interactions.

Course: M.Sc.; Specializations: Analytical, Inorganic, and Organic Chemistry
Practical Syllabus (Semester: II; Batch: 2021-22)

Practical – I: Inorganic Chemistry

(Minimum five experiments must be carryout) Max. Marks: 53 (43Prac. & 5Viva + 5Rec.)

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)

Reference Books:

1) Vogels Text Books of Qualitative analysis, Revised. J. asset, R.C. Denny, G.H. Jeffery and J. Mendhan. ELBS.
2) Synthesis and Characterisation of Inorganic Compounds, W.L.Jolly. Prentice Hall.
3) Practical Inorganic chemistry by G. Pass and H. Sutcliffe Chapman and Hall.
4) Practical Inorganic Chemistry by. K. Somasekhar Rao and K.N.K. Vani.

Course: M.Sc.; Specializations: Analytical, Inorganic, and Organic Chemistry
Practical Syllabus (Semester: II; Batch: 2021-22)

PRACTICAL-II: Organic Chemistry

(Minimum five experiments must be carryout) Max. Marks: 53 (43Prac. & 5Viva + 5Rec.)

1) Identification functional groups in organic compounds: Phenol, bases, organic acid, ketone, aldehyde, amide and carbohydrate with preparation of two solid derivatives.
   i) Identification of given two compounds with preparation of two solid derivatives and reporting of the melting points for derivatives.
2) Purification of derivatives- The student has to do Recryastallization to final derivatives(s) and submit the sample. If the sample is impure liquid must carryout distillation process.

Course: M.Sc.; Specializations: Analytical, Inorganic, and Organic Chemistry
Practical Syllabus (Semester: II; Batch: 2021-22)

Practical – III: Physical Chemistry

(Minimum five experiments must be carryout) Max. Marks: 53 (43Prac. & 5Viva + 5Rec.)

List of Experiments:

1) Potentiometric determination of Fe(II) with Cr (VI)
2) Potentiometric titration of chloride with silver nitrate.
3) pH-metric determination of strong acid with strong base.
4) Conductometric titration of strong acid with strong base
5) Verification of Beers Law using potassium permanganate.
6) Verification of Beers Law using Potassium dichromate.
7) Determination of formulae and stability constant of a metal complex by spectro photometric method.
8) Verification of Langmuir isotherm. Determination of unknown concentration of aceticacid by studying its adsorption on activated charcoal.

UNIVERSITYM.Sc. FINAL YEAR
CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – III

Paper-I: Organic Spectroscopy-I (CH301T (O))

Max. Marks: 70 M

Learning Objectives:

- ✓ To learn about the basics of various spectroscopic techniques.
- ✓ To understand the instrumentation of UV, IR, NMR, ESR spectroscopic techniques.
- ✓ To apply the spectroscopy knowledge for the structural elucidation of organic molecules.

UNIT-I

14H

UV-Vis Spectroscopy:

a) **UV Spectroscopy**: Energy transitions – Simple chromophores – UV absorption of Alkenes – polyenes unsaturated cyclic systems – Carbonyl compounds, α,β-unsaturated carbonyl systems - Woodward Fieser rules – aromatic systems – solvent effects – geometrical isomerism – acid and base effects – typical examples – calculation of λ_{max} values using Woodward - Fieser rules.

b) **ORD:** Theory of optical rotatory dispersion, α-Axial haloketone rule and octant rule – Application of these rules in the determination of absolute configuration of cyclohexanones, decalones and cholestanones.

c) **Circular Dichroism:** Principle – positive and negative cotton effects – Absolute configuration.

UNIT-II

12H

Infrared Spectroscopy (FT-IR): Fundamental modes of vibrations – Stretching and bending vibrations – overtones, combination bands and Fermi resonance, factors influencing vibrational frequencies, hydrogen bonding – fingerprint region and its importance – Study of typical group frequencies for – CH, -OH, -NH, -CO-NH_2, -CC, -CHO, -CO and aromatic systems.

Application in structural determination –Simple problems.

UNIT-III

14H

^{1}H NMR spectroscopy:

a) Magnetic properties of Nuclei, Nuclear resonance, Fourier Transformation and its importance in NMR. Equivalent and non-equivalent protons, The chemical shift and its importance, calculation of chemical shift, factors affecting the chemical shifts such as electronegativity and anisotropy, effect of deuteration, Signal integration, Spin-spin coupling: vicinal (Karplus

relationships), germinal and long range. Coupling constants (*J*) and factors affecting coupling constants. –Shielding and deshielding mechanisms in acetylene carbonyl and Benzene, anisotropy –Spin-Spin Interactions related to first order and higher order spectra (AB, A_2; AB_2, ABX, ABC, AMX) –temperature dependence spectra, Hydrogen bonding. Nuclear Overhauser effect (NOE).

b) Interpretation of NMR spectrum of a given compound leading to identification –typical examples of PMR spectroscopy.

UNIT-IV

10H

Electron Spin Resonance Spectroscopy (**ESR**):

a) Basic Principles, Comparison of NMR & ESR. Determination of 'g' value, Factors affecting the 'g' value. Isotropic and Anisotropic constants. Splitting, hyperfine splitting coupling constants. Line width, Zero field splitting, and Kramer degeneracy. Crystal field splitting, Crystal field effects.

b) **Applications:** Detection of free radicals; ESR spectra of
(a) Methyl radical ($CH_3^{\cdot}$), (b) Benzene anion ($C_6H_6^{-}$).

UNIT-V

10H

Common Problem on UV-Vis, FT-IR, and ^{1}H NMR:

a) Problems involving individual spectral methods – UV, IR, and PMR
b) Problems involving combined any two of UV, IR, and PMR
c) Problems involving all three UV, IR, and PMR spectral data.

Reference Books:

1) Spectrometric identification of organic compounds by R.N. Silverstein & G.C. Bassier (John Willey).
2) Spectroscopic methods in Organic Chemistry by Williams and Fleming (Mcgraw Hill).
3) "Organic Photochemistry" by R.O. Kan (Mc Graw Hill).
4) "Advanced Organic Chemistry Reaction Mechanisms and Structure" by J March (Mc Graw Hill & Kogshusha).

Learning Outcomes:

- ✓ Students can understand the fundamentals of spectroscopic techniques and apply to investigate the structural information of molecules.
- ✓ It can provide a platform to get the awareness towards UV, FTIR, ^{1}H NMR and ESR Spectrometry which aims to apply this knowledge towards research.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – III

Paper-II: Organic Synthesis & Reaction Mechanisms-I (CH302T (O))

Learning Objectives: **Marks: 70**

- ✓ To learn about the basics of tools required for determining reaction mechanisms
- ✓ To develop simple skills in writing mechanism of organic reactions.
- ✓ To understand different radical reactions involving additions, substitutions, and decompositions and their mechanisms
- ✓ To learn different approaches and reagents of various oxidation and reduction processes in organic synthesis and also their mechanisms
- ✓ To learn terminology and selectivity in asymmetric synthesis and also apply the approaches in organic synthetic reactions.

UNIT-I

10H

Methods for Reaction Mechanism by Kinetic & Non-Kinetic studies

Kinetic studies: Kinetics of reaction, Energy profile diagram, Intermediate versus transitionstate, Reaction rate and rate limiting step.

Non-Kinetic studies Identification of products, testing possible intermediates, trapping of intermediates, Cross over experiments, Isotopic labeling.

UNIT-II

10H

Free Radicals

Free radicals and their reactions-Introduction to radical reactions, Addition of halogens, Hydrogen halides. Substitution reactions- Halogenation, Aromatic substitution, Sandmayer reaction, Autooxidation, Decomposition of dialkyl and diacyl peroxides.

UNIT-III

14H

Oxidations

Introduction: Different Oxidative processes.

Hydrocarbon: Alkenes, aromatic rings saturated C-H groups (activated and unactivated), Alcohols, diols, aldehydes, Ketones, Carboxylic acids, Amines, hydrazines, sulphides. Oxidations with ruthenium tetroxide iodobenzene diaccetate and Tl(III) nitrate, Lead tetra acetate, SeO_2, MnO_2 Ag_2CO_3, peracids.

Oxidation of C=C perhydroxylation using $KMnO_4$, OsO_4, peracids.

UNIT-IV

14H

Reductions

Introduction: Reductive process Hydrocarbons: Alkanes, alkenes, alkynes, and aromatic rings Carbonyl compounds – aldehydes, ketones, acids and their derivatives. Nitro, nitroso, azo and oxime group Hydrogenolysis. Catalytic hydrogenations, Reduction by dissolving metals, Reduction with metal and acid. Reduction with metal in liquid ammonia (Birch reduction).

Reduction by hydride transfer reagents Aluminium alkoxide, $LiAlH_4$, $NaBH_4$, Diisobutyl aluminium hydrides –Sodium cyano borohydride ,tryalkyl borohydirdes – Reduction with diimide.

UNIT-V

12H

Asymmetric Synthesis-I

Terminology: Topocity in molecules Homotopic, stereo Heterotopic (enantiotopic and diastereotopic) groups and faces- symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re, and Si.

Selectivity in synthesis: Stereo specific reactions (substrate stereoselectivity). Conditions Stereo selective reactions (product stereoselectivity): Enantio selectivity and diastereoselectivity.:

Analytical methods: % Enantiomer excess, optical purity, % diastereomeric excess.

Reference Books:

1) Mechanism and structure in Organic Chemistry " E.S.Could Henry – Holt and Co, Newyork,
2) Advances in Organic Reaction mechanism and structure J. March (McGrew Hill),
3) Aguide Book to Mechanism in Organic Chemistry" by P.Sykes,
4) Synthetic approaches in organic chemistry by R.K.Bansal (Narosa Publications).
5) Some modern methods of synthesis by Carruthers (Cambridge).
6) Asymmetric synthesis by Nogradi,
7) Asymmetric organic reactions by it) Morrison and HS Moschcr,
8) Stereo differentiating reactions by Izumi.

Learning Outcomes:

- ✓ Students can understand the fundamental tools required for the determination of reaction mechanisms.
- ✓ Students can able to apply the reagents and approaches for various synthetic reactions involving oxidations and reductions
- ✓ The knowledge on asymmetric synthesis provides a platform for carryout various stereo chemical reactions wherever necessary to apply towards research.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – III

Paper-III: Alkaloids, Terpenoids, Quinones and Phenothiazines (CH303T (O)

Marks: 70

Learning Objectives:

- ✓ To learn about definition and importance of various alkaloids.
- ✓ To know the structure elucidation and synthetic methods of important alkaloids.
- ✓ To know the classification of terpenoids, isoprene rule, structures and their natural sources.
- ✓ To know the structure characterization and synthesis of quinines and phenothiazines.

UNIT-I

14H

Alkaloids-I: Definition, General methods of identification of alkaloids - nomenclature – occurrence – isolation – chemical tests for identification - general methods of structural elucidation – degradation – classification based on nitrogen heterocyclic ring – role of alkaloids in plants.

a) Structure and synthesis of Atropine, Caffeine.
b) Quinoline alkaloids: Chemistry and synthesis of Quinine, Cinchonine, and their stereochemistry.

UNIT-II

12H

Alkaloids-II:

a) Isoquinoline-Morphine Group Alkaloids: Papaverine, Hydrastine, narcotine, canadine, Coclawrine, Morphine, Codeine, emetine, Apomorphine, Glaucine
b) Stereochemistry of emetine, and morphine alkaloids.
c) Biogenesis of alkaloids.

UNIT-III

10H

Alkaloids-III:

a) Indole alkaloids: Reserpine, strychnine, brucine, lysergic acid, erogotamine
b) Structure, stereochemistry, synthesis and biosynthesis of Ephedrine, Conine and nicotine.

UNIT-IV

10H

Terpenoids: Classificaiton, sources, isolation, synthesis and stereochemistry with special reference to zingiberene, santonin, eudesmol, abietic acid, Biosynthesis of terpenoids.

UNIT-V

14H

Quinones and Phenothiazines:

Quinones: Identification of quinones, Lapachol. Chrysophenol and Physcion-chemistryand synthesis.

Phenothiazines: Classification, pharmacological properties of phenothaizines, general methodsof synthesis of phenothiazines with reference to Promazine, Prochlorperazine and Thioriazine.

Reference Books:

1) Alkaloids by K.W. Bentley Vols. I & II.
2) Text Book of Organic Chemistry I.L. Finar Vol. II 3.An introduction of alkaloids by G.A. Swain,
3) Naturally occurring quinines – R. H. Johnson Vol. I & II, Academic Press, London.

Other References:

1) Chemistry and physiology of alkaloids by Manske Vol. I & II, VII
2) Medicinal Chemistry by A. Burger
3) Isoquinoline Alkaloids by M.Shamma
4) Heterocylclic Chemistry by JA Joule etal., Chapman – Hall.

Learning Outcomes:

- ✓ Students can understand the definitions and importance of various alkaloids
- ✓ Students can understand the structure elucidation and also know the synthetic processes application and synthetic methods of studied alkaloids
- ✓ Basic ideas of isoprene rule, terpenoids classification, their natural sources, synthesis.
- ✓ Students can understand the structure characterization and synthesis of quinones and Phenothiazines.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – III

Paper-IV: Chemistry of Natural Products-I (CH304T (O))

Core Elective-I (CE-I)

Marks: 70

Learning Objectives:

- ✓ To know about classification and general methods of synthesis of various flavonoids.
- ✓ To know the structures and synthesis of Fat and water soluble vitamins.
- ✓ To know the classification of harmones, and synthesis of some steroidal and non-steroidal harmones.
- ✓ To know about aminoacids, proteins, enzymes, cofactors and prostaglandins.

UNIT-I

12H

Flavonoids and Prostagladins

Flavonoids: Classificaiton, sources, isolation, general methods of synthesis of flavones, flavanones, flavonols. Chemistry and synthesis with special reference to quercetin and kampferol.

Prostaglandins: Prostaglandins with special reference to PGE and PGF

UNIT-II

12H

Vitamins

Fat Soluble Vitamins: Chemistry, Synthesis & biosynthesis of vitamin A_1, vitamin E (α, β, γ, δ-tocopherols) and vitamin K

Water soluble Vitamins: Chemistry, Synthesis, and biosynthesis of B_1 and C

UNIT-III

12H

Steroidal Hormones

Chemistry & synthesis of equilenine, oestrone, progesterone, androsterone, testosterone,cortisone.

Non-steroid hormones: Chemistry & synthesis of thyroxin, epinephrine, and oxytocin.

UNIT-IV

12H

Amino Acids: Classification of amino acids. Specific methods of preparations –Malonic ester synthesis and Erlenmeyer azlactone synthesis. Isoelectric point.

Proteins: General nature of proteins – annealing, Biuret reaction, Ninhydrin test. Classification of proteins. Merrifield solid phase peptide synthesis. Primary, secondary, tertiary, and quaternary structure of proteins.

a) Enzymes: classification, kinetics, and mechanism of enzyme action
b) Coenzymes and cofactors: NAD FAD folic acid citric acid cycle.

UNIT-V

12H

Insecticides

Naturally occurring insecticides: Introduction, general properties, sources, isolation, synthesis, and stereochemistry of Pyrethrin I and II; Jasmolin I & II; Structure activity relationship (SAR) studies and biosynthesis of pyrethrins

Rotenoids: Chemistry and synthesis of rotenone

Isobutylamines: Chemistry and synthesis of anacyclin, and spilanthol .

Minor insecticides of plant origin: Pachyrrhizin and custard-apple.

Reference Books:

1) Steroids by Fieser and Fieser,
2) The Vitamins by S.F. Dykes,
3) The Natural Pigments by K.W. Bentley,
4) Biological Chemistry by Holum,
5) Organic Chemistry Vol.II by I.L.Finar,
6) Naturally occurring insecticides by M. Jacobson and D.G. Crosby, Marcel- Decker Inc, New York.
7) General Organic and Biochemistry by F.A. Bettelheim and Jerry March, Saunders College, Publishing.

Further Study:

1) The terpenoids by Simonsen,
2) The steroids by Shoppee,
3) Chemistry of Carbon compounds by Rodd.

Learning Outcomes:

- ✓ Students can understand the classification and general methods of synthesis of various flavonoids.
- ✓ Students can understand the synthesis of fat and water soluble vitamins
- ✓ To know the classification of harmones, and synthesis of some steroidal and non-steroidal harmones
- ✓ Students can able to understand functions, structures and synthesis amino acids, proteins, enzymes, cofactors and prostaglandins
- ✓ Students able to understand different types of naturally occurring insecticides and their specific and commercial importance.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – III

Paper-V: Applications of Synthetic Products (CH305T)

Other Elective –I (OE-I)

Marks: 70

Learning Objectives:

- ✓ To know the basics of dyes, drugs and also their importance.
- ✓ To know about the production and working of soaps, detergents and formulations of cosmetics.
- ✓ To know about flavours, sweeteners, insecticides, and their applications.
- ✓ To know about explosions and polymer types.

UNIT-I

12H

Dyes: Colour and constitution, classification, dyeing method, and their industrial importance.

Drugs: Basic concepts, classification, sources, the requirement of an ideal drug.

UNIT-II

12H

Synthetic Drugs: Structure and medicinal properties.

Sulphanilamide: An example of sulpha drug - paracetamol, aspirin, oil of wintergreen;Mephensin. A muscle relaxant; Ibuprofen – an anti-inflammatory drug; L-dopa-cures Parkinson's disease;

UNIT-III

12H

Soaps and Detergents: Production and their cleansing action.Liquid crystals and their applications. Surfactants

Cosmetics: Detailed study of formulations and manufacturing of cream and lotions, lipstick andnail polish, shampoos, hair dyes, and toothpastes.

Flavours: Natural flavouring materials and classification.

UNIT-IV

12H

Sweeteners: Natural and Synthetic sweeteners.

Pesticides: Introduction, Classification, Applications and their effect on the environment.

Insecticides: Introduction, Classification, Applications and their effect on the environment.

Explosives: Introduction, RDX, Gun Powder.

UNIT-V

12H

Polymers: Introduction, biodegradable and non-biodegradable polymers and their industrial importance, plastics (uses and effects on environment), natural and synthetic rubbers, polyamides, and polyesters like nylon, decron, terelyne. Thermoplastics–Poly carbonates, Poly acrylates in lens applications, Polyurethanes, and conducting polymers.

Reference Books:

1) I.L. Finar, Organic Chemistry, ELBS Longmann, Vol. I & II, 1984.742.
2) K. Albert, L Lehninger, D. L. Nelson, M.M. Cox, Principles of Biochemistry, CBZ Publishers, 1st Edition, New Delhi, 1993.
3) Harper's Biochemistry, Ed. R. Harper, 22nd Edition, Prentice Hall Press, New York, 1990.
4) Encyclopedia of Chemical Technology – Kirck – Othmer Series.
5) Harper's Review of Biochemistry – P.W. Martin, P.A. Mayer & V.W. Rodfwell, 15th Edition, Maurzen Asian Edition, California, 1981.
6) Polymer Science, Gowarikar.
7) Industrial Chemistry, B.K. Sharma.

Learning Outcomes:

- ✓ The students able to understand dyes and their industrial importance.
- ✓ The students understand the cleansing action of soaps, manufacture of cosmetics and use of flavours and sweetness.
- ✓ The students able to understand effects of pesticides and insectides to the environment.
- ✓ The students understand about explosive materials and preparation & use of polymers in industries.

PRACTICAL SYLLABUS

Course: M.Sc. Specialization: ORGANIC CHEMISTRY

Semester: III; From Admitted Batches: 2021-22

PRACTICAL-I: Multistage Organic Synthesis

(Any five experiments must be carryout) **Max. Marks: 70 (60 Prac. + 10 Rec.)**

Expt-1: Synthesis of paracetomol from benzene

Step 1: Benzene to Nitrobenzene (Nitration)

Step 2: Nitrobenzene to N-phenyl hydroxylamine (reduction)

Step 3: N-phenyl hydroxyl amine to *p*-aminophenol (Rearrangement) Step 4:

p-amino phenol to *p*-hydroxy acetanilide/paracetomol(acetylation)

Expt-2: Synthesis of *o*-chlorobenzoic acid from phthalic acid

Step 1: Phthalic acid to phthalic anhydride (Dehydration)

Step 2: Phthalic anhydride –phthalic amide (Amide formation)

Step 3: Phthalmide- Anthranilic acid (Hoffman's Bromamide reaction)Step 4:

Anthranilic acid -*ortho*-chloro benzoic acid

Expt-3: Synthesis of sulpha drug from aniline

Step 1: Aniline to acetanilide

Step 2: Acetanilide to *p*-acetamide benzene sulphonyl chloride (sulphonation)

Step 3: *p*-acetamide benzenesulphonylchloride to *p*-acetamide benzenesulphonamide (s-amination)

Step 4: *p*-acetamide benzene sulphonamide to *p*-amino benzenesulphonamide(hydrolysis)

Expt-4: *m*-Chloro-nitrobenzene from nitrobenzene

Step 1: Nitro benzene to *m*-dinitro benzene (nitration)

Step 2: *m*-dinitrobenzene to *m*-nitro aniline (partial reduction) Step 3:

m-nitro aniline to *m*-nitrodiazoniumchloride (diazotization)

Step 4: *m*-nitrodiazoniumchloride to *m*-Chloro-nitrobenzene (sandmayers reaction)

Expt-5: Synthesis of *p*-bromo benzanilide from benzophenone

Step 1: Benzophenone to benzopenone oxime (Addition)

Step 2: Benzophenone oxime to benzanilide (Beckman's rearrangement)Step

3: Benzanilide to *p*-bromobenzanilide) (bromination)

Expt-6: Synthesis of Methyl orange from aniline

Step 1: Aniline to sulphonic acid (sulphonation)

Step 2: sulphonic acid to Diazonium chloride (diazotization) Step 3:

Diazonium chloride to methyl orange (coupling reaction)

Expt-7: Synthesis of Acridone from Anthranilic acid

Step 1: Anthraninilc acid to o-chlorobenzoic acid (Diazotosation followed by sandmayer's reaction)

Step 2: o-chlorobenzoic acid to N-phenyl anthranilic acid (Substitution)Step 3:

N-phenyl anthranilic acid to acridone (Cyclisation)

Note: All the students must submit the TLC for all the stages of preparation and a photo copy must be pasted in records.

References:

1. Practical Organic Chemistry A.I.Vogel (Longmans)
2. Text Book of practical organic Chemistry F.G.Mann & B.C. Sanders.
3. A Manual of Practical Organic Chemistry Day Sitaramam & Govindachari
4. Organic Experiments L.F.Fieser.
5. Practical Organic Chemistry H.T.Openshaw
6. Systematic Identification of Organic Compounds, P.L.Shriner, R.C.Fuson & D.Y.Curtin.
7. Identification of Organic Compounds N.D.Cheronis & J.B.Entrilkin
8. Advanced Organic Synthesis by R.S.Monson Academic Press

Note: For University Practical Examination: Duration: 9 hours.

Course: M.Sc., Specialization: ORGANIC CHEMISTRY Semester: III; From Admitted Batches: 2021-22

PRACTICAL–II :: Organic Estimations

(Any six experiments must be carryout) Max. Marks: 70 (15 QA+45 Prac.+10 Rec.)

Part I: One theory question either relating to spectral characterization or any practical or as wish by the examiner. 15M

Part II: The following Estimations/Isolations 45M

Expt. 1: Estimation of hydroxyl group by acetylation or pthalation method

Expt. 2: Estimation of phenol (bromination method)

Expt. 3: Estimation of aniline (Bromination method)

Expt. 4: Estimation of carbonyl groups (Hydrazone formation method)

Expt. 5: Estimation of sugars –glucose and sucrose by using Fehlings solution

Expt. 6: Determination of iodine value of oil or fat

Expt. 7: Determination of saponification value of oil or fat

Expt. 8: Estimation of vitamin 'C' in lime juice.

Expt. 9: Isolation of caffeine from tea/coffee sample.

Part-III: Record Submission **10M**

For University Practical Examination: Duration: 9 hours

ACHARYA NAGARJUNA UNIVERSITY
M.Sc. FINAL YEAR CHEMISTRY
Effective for the students admitted from the year 2021 – 2022
SEMESTER – IV
Paper-I: Organic Spectroscopy-II (CH401T (O))

Marks: 70

Learning Objectives:

- ✓ To learn about the basics of ^{13}C NMR, Mass, and 2D NMR spectroscopic techniques.
- ✓ To understand the instrumentation of Mass, types of ionizations, types of analyzers in Mass spectroscopic techniques.
- ✓ To apply the spectroscopy knowledge for the structural elucidation of natural products and stereochemistry of organic compounds.

UNIT-I

14H

^{13}C NMR Spectroscopy:

Types of 13C NMR spectra, Undecoupled, proton- decoupled, single frequency off-resonance decoupled (SFORD) and selectively decoupled spectra. Signal enhancement by Nuclear OVER HAUSER effect. ^{13}C chemical shifts, factors affecting the chemical shifts. Noise decoupled and off-resonance spectra of simple Compounds. Calculation of chemical shifts of alkanes, alkenes, alkynes, and aromatic compounds. Typical examples of CMR spectroscopy –problems.

UNIT-II

14H

Mass Spectroscopy:

Introduction, principles of ionization methods: EI, CI, FDI, PDI, LDI, FAB, TSI and ESI, Types of mass analyzers; Types of fragments- odd electron and even electron containing neutral and charged species (even electron rule), nitrogen rule, molecular-ion peak, base peak, metastable ion, isotopic abundance. High Resolution-MS (HRMS), index of hydrogen deficiency (IHD). Fragmentation of typical organic compounds - hydrocarbons, aromatics, alcohols, alkyl halides, ethers, Carbonyls, carboxylic acids, esters, amines, amides, nitro compounds. General methods of mass spectral fragmentation-β-cleavage, Mclafferty rearrangement, retro Diels-Alder fragmentation and ortho effect. Factors affecting fragmentation– Mass spectra related problems.

UNIT-III

10H

2D NMR Techniques:

Principles of 2D NMR, classification of 2D-experiments, 2D-J-resolved spectroscopy. Correlation spectroscopy (COSY), HOMO COSY (^{1}H-^{1}H COSY), COSY of *m*-dinitrobenzene, isopentyl acetate, Hetero COSY (1H, ^{13}C COSY) Hetero COSY of isopentyl acetate and 4- methyl-2-pentanol, HMQC, HMQC of codeine, long range ^{1}H, ^{13}C COSY (HMBC), HMBC of codeine and NOESY, NOESY of 9-benzylanthracene, 2-D INADEQUATE experiments.

UNIT-IV

12H

Spectral characteristics of natural products involving all spectral data: Use of spectroscopic methods UV, IR, ^{1}H and ^{13}C NMR and Mass spectra in the structure elucidation of natural products. Illustration with suitable compounds like Apigenin (Flavone), Kaempferol (flavonol), Umbelliferone (coumarin), Camphor (Terpenoid), Lawsone (Naphthoquinone), Papaverine (Alkaloid), and Equilenine (steroid).

UNIT-V

10H

Spectral Problems:

Applications of ^{13}C NMR spectroscopy: Stereochemistry, and reaction mechanisms. Applications of ^{1}H NMR spectroscopy: Stereochemistry-Geometrical and optical isomerism.

Spectral Problems involving all spectral data UV-Vis. ^{1}H NMR, ^{13}C NMR, Mass spectrometry &2D NMR techniques.

Reference Books:

1) Spectrometric identification of organic compounds by R.N.Silverstein & G.C.Bassier (John Willey)
2) Spectroscopic methods in Organic Chemistry by Williams and Fleming (McGraw Hill).
3) Organic photochemistry by R.O.Kan (Mc Graw Hill)
4) Advanced organic Chemistry Reaction Mechanisms and Structure by J March (Mc Graw Hill & Kogshusha).
5) Carbon-13 NMR Spectroscopy by J.B. Stothers.

Learning Outcomes:

- ✓ Students can understand the fundamentals of ^{13}C NMR and Mass spectroscopic techniques and apply to investigate the structural information of molecules.
- ✓ It can provide ability to apply the spectroscopy knowledge for the structural elucidation of natural products and stereochemistry of organic compounds
- ✓ It also provides platform for awareness towards ^{13}C NMR and Mass Spectrometry which aims to apply these knowledge towards research.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

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SEMESTER – IV

Paper-II: Organic Synthesis & Reaction Mechanisms-II (CH402T (O)

Marks: 70

Learning Objectives:

- ✓ To learn about the basics of C-C single and double bond formations and Diels-Aider reactions.
- ✓ To learn terminology and develop skills in writing retro-synthetic routes for target molecules with one and two functional groups.
- ✓ To learn different approaches in photochemical and pericyclic reactions.
- ✓ To learn terminology and selectivity in asymmetric synthesis and also apply the approaches in organic synthetic reactions.

UNIT-I

14H

Formation of C-C single & double bonds and Diels–Aider & related reactions:

Formation of C-C single bonds–enamines and related reactions.

Formation of C-C double bonds–Corey-winter olefination, Peterson olefination, Julia olefination, McMurry coupling, witting reaction of Phosphorus ylides–stereoselective synthesis of tri and tetra- substituted alkenes.

Diels–Aider and related reactions – diene-dienophile, intramolecular Diels –Alder reactions, Stereochemistry and mechanism Retro Diels – Alder reaction –1, 3-dipolar reactions.

UNIT-II

12H

Synthetic Strategies or Retro Synthetic analysis: Terminology- Target Molecule(TM), synthon, synthetic equivalent, functional group interconversion (FGI), and representation of disconnection of bonds. Linear and convergent synthesis. One group and two group disconnections in simple molecules- Alcohols, Olefins, aryl ketones, α,β-Unsaturated compounds

– 1,3 dicarbonyl compounds. synthesis involving chemoselectivity, regioselectivity, reversal of polarity and cyclizations.

UNIT-III

10H

Photochemistry: Photochemistry of olefins–conjugated olefins–Aromatic compounds–isomerisation–additions. Photochemistry of carbonyl compounds – Norrish type I and II reactions –Paterno – Buchi Reaction. Photo reduction, Photochemical rearrangements–Photo Fries rearrangement, Di-π-methane rearrangement.

UNIT-IV

12H

Pericyclic Reactions: Definition, classification, MO theory, Electronic configuration in ground and first excited states of aliphatic conjugated polyene system (upto 4 double bonds).

Electrocyclic Reactions: Mechanism, stereochemistry, PMO, FMO, correlation diagram, Woodward Hoffman rules. **Cycloaddition Reactions**: FMO and correlation diagram methods-(2+2) and (4+2) cycloaddition reactions, stereochemistry. Woodward Hoffman rules.

Sigmatropic Rearrangement: classification, Mechanism by FMO method, Woodward Hoffman rules. Cope, claisen and Aza-cope rearrangements.

UNIT-V

12H

Asymmetric Synthesis-II: Substrate controlled asymmetric synthesis: Nucleophilic additions to chiral carbonyl compounds. 1,2- asymmetric induction, Cram's rule, and Felkin-Anhmodel. i) Chiral auxiliary controlled asymmetric synthesis: Į-Alkylation of chiral Enolates, aza enolates, 1,4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in DielsAlder and Aldol reactions. ii) Chiral reagent controlled asymmetric synthesis: Asymmetric reductions using BINAL-H.; Asymmetric Hydroboration using $(IPC)_2$ BH and $IPCBH_2$.

Reference Books:

1) Some Modern methods of synthesis By Caruthers (Cambridge)
2) Organic synthesis by Robert & Ireland (Printce Hall of India)
3) Designing Organic Synthesis B staurt Warron, John Wiley & Sons
4) "Pericyclic reactions a mechanistic study" S.M. Mukheji
5) Synthetic approaches in Organic Chemistry " R.K. Bansal Narosa Publications
6) Advances in Organic Chemistry – Reaction mechanism and structure" by J. March (Mc Graw Hill).
7) 'Organic Photo chemistry and Pericyclic reactions' M.G. Arora Anmol Publications Pvt. Ltd.
8) Fundamentals of photochemistry by K.K. Rohatgi–Mukharjee Now Age international publishers.
9) Photochemistry by C W S Wells.
10) Organic Photochemistry by Turro.
11) Molecular Photo chemistry by Gilbert & Baggo.
12) Organic Photo chemistry by D Coyle.
13) Asymmetric synthesis by Nogradi.
14) Asymmetric organic reactions, J. D. Morrison and H. S. Moschcr.
15) Principles of Asymmetric synthesis, R. E. Gawley and J. Aube, 2nd Ed., Elsevier, 2012.

Learning Outcomes:

- ✓ Students understand the basics of C-C single and double bond formations and Diels–Aider reactions.
- ✓ Students learnt the terminology and develop skills in writing retro-synthetic routes for target molecules with one and two functional groups.
- ✓ Students learnt different approaches in photochemical and pericyclic reactions
- ✓ Students are able to understand the terminology and able to know selectivity in asymmetric synthesis and also able to apply the approaches in organic synthetic reactions.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – IV

Paper-III: Chemistry of Antibiotics and Drugs (CH403T (O)) **Marks: 70**

Learning Objectives:

- ✓ To know the basics on antibiotics, their importance and various drugs in medicinal chemistry.
- ✓ To know the chemistry of structures and synthesis of some antimalarials, sulpha drugs, antiseptic and antifungals.
- ✓ To know the classification of herbal drugs and their therapeutic efficacy and isolation.

UNIT-I

12H

Antibiotics:

Synthesis of penicillin-G, ampicillin, amoxicillin, chloramphenicol, cephalosporin.Streptomycin, tetracyclines, Terramycin, aureomycin, gramicidin.

UNIT-II

12H

Drugs and Medicinal chemistry:

Anticancer Agents: Synthesis & Activity relationship of Taxol, Vinblastine, Vincristine, Camptothecin.

CNS stimulants: Strychnine (CNS activity only), caffeine, Nicotine; CNS depressants, General anesthetics, mode of action of Sedatives & Hypnotics.

UNIT-III

12H

Antimalarials: Paludrin – quinacrin – chloroquin – camoquin – pamaquin – sontoquine.

Sulpha drugs: Sulphanilamide – Dihydrocurprine – Prontosil

UNIT-IV

12H

Antiseptics and Antifungal agents

Antiseptics: Common types, triclosan, aminacrine hydrochloride. Antiseptics *Vs* Disinfactants- Properties, Mechanism of action, classification

Antifungal agents: 1,8-dihydroxyanthranol – griseofulvin.

UNIT-V

12H

Herbal Drugs: i) Classification of herbal drugs- Pharmacological and Chemical classification. ii) Adulteration and evaluation of drugs. iii) Different chemical groups of Herbal drugs- Alkaloids, Terpenoids, Glycosides, Volatile oils, Isolation of volatile oils, Tannins, and carbohydrates. iv) Herbal drugs and their therapeutic efficacy. Isolation of- Laxative-Aloe-

emodin from Aloes. Anti-diabetics- Neem oil (Neem); Anti-malarial- Quinine (cinchona); Anti-hypertensive- Reserpine (rauwolfia).

Reference Books:

1) Introduction to Medicinal Chemistry – Wiley VCH
2) Text Book of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvild, (ed Robert F. Dorge)
3) An introduction to drug design by SS Pandeya
4) Buger's Medicinal Chemistry and drug discovery Vol.I by (Ed) ME Wolff – John – Wileyby A. Burger
5) The Organic Chemistry of drug design and drug action by RB Silverman, Academic press
6) Principles of Medicinal Chemistry by William O. Foye, Lea & Febiger, Philadelphia/London, 1989.
7) Natural products. By P.S.Kalsi
8) Medicinal chemistry. By Chatwal.- And By Ashtoshkar.
9) Chemistry of Drugs. By V.N.Ivers.
10) May's chemistry of synthetic drugs. Hand Book of Reagents for organic synthesis. By Reich,Rigby
11) Top Drugs: The synthetic routes. J.Saunders
12) Organic natural products By Barton and Ollis
13) Organic natural products by OP Agarwal
14) Organic natural products By Barton and Ollis.

Learning Outcomes:

- ✓ Students under the basics on antibiotics, their importance and various drugs used in medicinal chemistry.
- ✓ Students are able to understand chemistry and synthesis of antimalarials, sulpha drugs, antiseptic and antifungals used in medicine.
- ✓ Students can identify the classification of herbal drugs in various types and understand their therapeutic afficacy and isolation methods.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – IV

Paper-IV: Advanced Organic Chemistry (CH404T (O))

Core Elective-II (CE-II)

Marks: 70

Learning Objectives:

- ✓ To introduce novel named reactions in modern organic synthesis.
- ✓ To know importance and principles of green chemistry, and microwave assisted reactions.
- ✓ To know the role of Nanochemistry in various fields and synthesis methods (Solid and Gase phase).
- ✓ To introduce green chemistry and microwave assisted reactions.
- ✓ To know use of organoboranes and organosilanes in synthesis.
- ✓ To introduce supramolecular chemistry and to know the mechanism of building blocks.

UNIT-I

12H

Advanced named Reactions in Organic Synthesis:

Baylis-Hillmon reaction, RCM Olefin metathesis, Grubb's catalyst, Mitsunobu reaction, Suzuki Coupling, Heck Coupling, Stille Coupling, Sonagashia, Coupling, Negishi Coupling, Hiyama Coupling, Buchwold – Hartwig Reaction, Click Reaction.

UNIT-II

10H

Nano Chemistry

Introduction, Carbon Nanotubes: structure of single and multi wall carbon nanotubes, synthesis-solid and gaseous carbon source-based production techniques, synthesis with controlled orientation. Growth mechanism of carbon nanotubes-catalyst free growth, catalyst activated growth, nano buds, nanotorus properties-general, adsorption, electronic & optical, Mechanical and reactivity. Defects, Toxicity Applications.

UNIT-III

14H

Green Synthesis:

Introduction, Principles, Green solvents- supercritical fluids, water, ionic liquids and PEGs as green solvents for organic reactions. Examples of green reactions-synthesis of Ibuprofen, Clean Fischer-Indole synthesis comparison of the above with conventional methods.

Microwave Organic Synthesis: Introduction, Applications: Microwave-assisted reactions in water (oxidation of toluene to benzoic acid, oxidation of alcohols); organic solvents (Diels-Alder reaction and Decarboxylation); solvent-free reactions (solid state reaction)-Michael addition and

Knoevenagel reaction), multistep V/s single pot synthesis.

UNIT-IV

12H

Organoboranes and Silanes:

Organoboranes: Synthetic applications of organoboranes – protonolysis, oxidation, carbonylation Reaction of alkenyl borane – enantioselective synthesis of secondary alcohols from alkenes.

Organosilanes: Synthesis of organosilanes, general features of carbon-carbon bond forming reactions of organosilicon compounds, addition reactions with aldehydes and ketones, acylation reactions, conjugate addition reactions.

UNIT-V

12H

Supramolecular Chemistry: Introduction - the meaning of supramolecular chemistry, phenomenon of molecular recognition and their quantification Building blocks of supramolecular chemistry - acyclic receptors for neutral and charged guests, macrocycles and crown ethers, macrobicycles and cryptands, macropolycycles, cucurbituril and cyclodextrins.

Reference Books:

1) New trends in green Chemistry by V.K.Ahluwalia
2) Organic synthesis by Robert & Ireland (Printce Hall of India)
3) Designing Organic Synthesis B staurt Warron, John Wiley & Sons
4) Green chemistry, ***V.K.Ahluwalia***, Ane books.
5) P.T. Anastas and J.C.Warner ***Green chemistry***, Oxford.
6) G.A.Ozin, A.C. Arsenault ***Nano chemistry***, RSC.
7) Diwan, Bharadwaj, ***Nanocomposites***, Pentagon.
8) V.S.Muralidharan A.Subramania, ***Nanoscience and Technology,*** Ane Books.
9) J.W Steed and J.L Atwood, Supramolecular chemistry, John Wiley & Sons, Ltd. New York.
10) Piet W. N. M. van Leeuwen, Supramolecular Catalysis, Wiley-VCH Verlag GmbH & Co.
11) Principles and methods in supramolecular chemistry, Hans-Jorg Schneider and A.Yatsimirsky, John Wiley and Sons.
12) Analytical Chemistry of Macrocyclic and Supramolecular Compounds, S.M.Khopkar, Narosa Publishing House.

Learning Outcomes:

- ✓ Students able to understand novel named reactions and applications in modern organic synthesis.
- ✓ Students understand the importance and principles of green chemistry, microwave assisted reactions and know applying the green synthesis to organic reactions.
- ✓ Students know current importance of Nanochemistry in various fields and their synthetic methods (Solid and Gase phase).
- ✓ It provides the knowledge of usinf organoboranes and organosilanes in synthesis.
- ✓ Students understand requirements of guest and host and formation of building blocks of supramolecular chemistry.

ACHARYA NAGARJUNA UNIVERSITYM.Sc. FINAL YEAR CHEMISTRY

Effective for the students admitted from the year 2021 – 2022

SEMESTER – IV

Paper-V: Forensic Science - In Solving Crime (CH405T)

Other Elective (OE-II)

Marks: 70

Learning Objectives:

- ✓ The significance of Forensic science to human society.
- ✓ The fundamental principles and functions of Forensic science.
- ✓ The divisions in a Forensic science laboratory.
- ✓ The various steps to be taken to thoroughly record the crime scene.
- ✓ The legal importance of chain of custody.

UNIT-I

12H

Introduction to Forensic Science: Need and functions of Forensic science. Historical aspects of Forensic science. Development of Forensic Science Laboratories. Definitions and concepts in Forensic science. Basic principles of Forensic science. Scope of Forensic science. Governing principals of Forensic Science. Forensic Science in Indian scenario. Admissibility in Indian Courts. Frye standard and Daubert standard.

Unit-II

12H

Divisions of Forensic Science

Branches of Forensic science and their importance. Hierarchical set up of various Government Forensic Science Laboratories.

Forensic Evidences: Concise of Forensic Physical, Biological, Chemical and Psychological evidences, Medico-Legal Cases. Legal and Scientific problems. Forensic intelligence and Interviews.

UNIT-III

12H

Crime Scene

Types of crime scenes. Safety measures at crime scenes. Role of First Responding Officer. Coordination between police personnel and Forensic scientists at crime scenes. The evaluation of

5Ws (who? what? when? where? why?) and 1H (how?)

UNIT-IV

12H

Police and Forensic Science

Relationship between police and forensic expert, Role of Police at the Crime scene, scientific help at crime scene, Importance of Chain of custody, handling of various types of crime scenes by police, forensic teaching of police personals, forensic case documentation by Police, Technological Advance and Police, Mobile device forensics, Role of Media, Human Rights Commission & Criminal Justice System.

UNIT-V

12H

Administration and Organizational Setup:

DFSS, CFSL, GEQD, SFSL, RFSL, MFSL, FPB, NICFS, CDTS, NCRB, BPR&D, Qualifications and duties of Forensic Scientists Academic centres of education and research: Indian and Academy of Forensic Science, American Board of Forensic Science, American Board of Forensic Odontology, Bureau of Alcohol Tobacco and Firearms, Interpol and FBI, Australian Academy of Forensic Sciences. Forensic Science in India: Teaching Courses and Research fields in Forensic Science, Scope and jobs in Forensic Science.

Learning Outcomes:

- ✓ The definition and difference between Forensic Science and Criminalists.
- ✓ The major contributors to the development of Forensic Science.
- ✓ Importance of physical evidence.
- ✓ To Learn Forensic Technology solving crimes with advanced technology
- ✓ Explain the steps typically required to maintain appropriate health and safety standards at the crime scene.

PRACTICAL SYLLABUS

Course: M.Sc.; Specialization: ORGANIC CHEMISTRY

Semester: IV; From Admitted Batches: 2021-22

Practical-I: Analysis of Binary Organic Mixture

Max. Marks: 70 (15QA+45Prac.+10Rec.)

Part I: One theory question relating to any topic out of four semesters or any practical or as wish by the examiner. 15M

Part II: Two component organic mixture analysis 45M

The mixture separation should be done by chemical methods and their identification by chemical reactions. Separation is based on solvent selection like ether, dil HCl, 5 % aqueous $NaHCO_3$, and Na_2CO_3 solutions, checking the purity of two components by TLC, identification of the compounds by a systematic study of the physical characteristics (mp/bp), extra elements (nitrogen, halogens and sulfur), functional groups, preparation of crystalline derivatives and identification by referring literature data.

(The student must be given trained in at least eight mixtures with different functional groups)

Note: 1. *For University examinations the student has to submit at least one derivative for each individual component. Examination- Duration: 9 hours.*

Part-III: Record submission 10M

Course: M.Sc.; Specialization: ORGANIC CHEMISTRY Semester: IV; From Admitted Batches: 2021-22

Practical-II: Project Work/Review of Literature/Spectral Problems

Max. Marks: 100

Title Selection: 1) Project Work / 2) Review of Literature (only on respective Chemistry specialization topics) / 3) Spectral Problems

1) **Project Work:** For University students- Project Work / Internship is compulsory and have to submit a dissertation containing Back ground of the work, Experimental, Results and Discussion and Summary.
   ***In respect of affiliated Colleges*-**Project work is optional for only colleges having doctorate degree faculty and students may opt for project work and others have to select *Spectral Problems paper/Review of literature* on core topics only.
2) **Review of Literature:** The students opted for Review of literature paper must be assigned a latest topic in chemistry and the students have to submit a dissertation (40-50 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 Review of Literature paper.
3) **Spectral Problems:** For students who selected spectral problems will be given spectra of two different compounds for structural elucidation along with Viva-voce. (A minimum of 10 representative examples should be studied in regular practical hours).

Course: M.Sc.; Specialization: ORGANIC CHEMISTRY Semester: IV; From Admitted Batches: 2021-22) Practical-III: Comprehensive Viva-voce

Max. Marks: 50 M

The students will be analyzed with questions covering all four semester topics.