A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A)

KAKINADA – 533 002, EAST GODAVARI, A.P.

DEPARTMENT OF CHEMISTRY

SYLLABUS

2024-25

SEMESTER – I

COURSE - I

Syllabus:

UNIT I: ESSENTIALS OF MATHEMATICS: 9hrs

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus-Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles

Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems

Statistical Measures: Mean, Median, Mode of a data and problems

UNIT II: ESSENTIALS OF PHYSICS: 9hrs

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance, Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions, Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principleTheories and understanding of universe

UNIT III: ESSENTIALS OF CHEMISTRY: 9hrs

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.

UNIT IV: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY: 9hrs

Applications of Mathematics in Physics & Chemistry: Calculus, Differential Equations & Complex Analysis Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies. Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

UNIT V: ESSENTIALS OF COMPUTER SCIENCE: 9hrs

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP Domain Name Services, applications. Ethical and social implications: Network and security concepts-Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Additional inputs: Probability, Chemical bonding, Octet rule, VB theory, MO theory, Drug

development, Food adulteration, Computer Architecture**.**

Reference Books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Chemsitry in daily life by Kirpal Singh
8. Chemistry of bio molecules by S. P. Bhutan
9. Fundamentals of Computers by V. Raja Raman

SEMESTER – I

Course –II

Syllabus:

UNIT I: ADVANCES IN BASICS MATHEMATICS **9hrs**

Straight Lines: Different forms – Reduction of general equation into various forms –Point of intersection of two straight lines Limits and Differentiation: Standard limits – Derivative of a function - Problems on product rule and quotient rule Integration: Integration as a reverse process of differentiation – Basic methods of integration Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants.

UNIT II: ADVANCES IN PHYSICS: **9hrs**

Renewable energy: Generation, energy storage, and energy-efficient materials and devices. Recent advances in the field of nanotechnology: Quantum dots, Quantum Communicationrecent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

UNIT III: ADVANCES IN CHEMISTRY: **9hr**

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

UNIT IV: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY 9h's

Mathematical Modelling applications in physics and chemistry Application of Renewable energy: Grid Integration and Smart Grids, Application of nanotechnology: Nanomedicine, Application of biophysics Biophysical Imaging, Biomechanics, Neurophysics, Application of medical physics: Radiation Therapy, Nuclear medicine Solid waste management, Environmental remediation- Green Technology, Water treatment.

UNIT V: Advanced Applications of computer Science **9hrs**

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Additional inputs: Methods in Matrix, Nanomaterials in drug delivery, Metal organic frame works and their role in dye removal, Nanotechnology, Principles of Green Chemistry, Demultiplexing.

Reference Books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications

2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna PrakashanMedia(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas

SEMESTER – II

Course –III

Syllabus:

Unit - I: Atomic Structure and Periodic table **9 h**

Electronic configuration: Bohr theory, dual nature of electrons, Heisenberg uncertainty principle, the Schrodinger time independent equation, significance of wave functions, Pauli's exclusion principle, Hund' rule, sequence of energy levels (Aufbau principle).

Periodicity: Periodic law and arrangement of elements in the periodic table (Groups and Periods) Genera properties of atoms: size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii ionization potential, electron affinity; electro negativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect;

UNIT - II: Ionic bond **9 h**

Properties of ionic compounds, factors favoring the formation of ionic compounds, ionization potential, electron affinity, and electronegativity. Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Stability of ionic compounds in terms of ΔH_f and Uo. Solubility and thermal stability of ionic compounds. Covalent character in ionic compounds-polarization and Fajan's rules and its applications.

UNIT - III: The Covalent Bond **9 h**

Valance Bond theory- hybridization of atomic orbitals and geometry of molecules-$BeCl_2$, BF_3, CH_4, PCl_5, SF_6, effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity, Isoelectronic principle, illustration of structures by VESPR model: NH_3, H_2O, SF_4, ICl^-_4, ICl_2^-, XeF_4, XeF_6. Molecular orbital theory-LCAO method, construction of M.O. diagrams for homonuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO).

UNIT - IV: Metallic and Weak Bonds **9 h**

The Metallic bond: metallic properties, free electron theory, Valence Bond Theory, Band theory of metals. Explanation of conductors, semiconductors and insulators.

Weak bonds: hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O and F compounds; associated molecules-ethanol and acetic acid; Vander Waals forces, ion dipole-dipole interactions.

UNIT - V: Acids and Bases **9 h**

Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Lewis theory, the solvent system, Non aqueous solvents: classification-protonic and aprotic solvents, liquid ammonia as solvent-solutions of alkali and alkaline earth metals in ammonia.

Types of chemical reactions: acid-base, oxidation-reduction, calculation of oxidation number. Definition of pH, pKa, pKb. Types of salts, Salt hydrolysis. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

Additional inputs:

Metals, Non-Metals, Metalloids, Coloumbs Law and Bornlande Equation, Applications of Semi Conductors, Similarities and differences between Ionic and Metallic Bonds, Characteristics of Covalent Bond, Theories of Acid Base indicators : Ostawalds Theory and Benzenoid Quininoid Theory.

List of Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., 1996.
3. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3 rd ed., W. H. Freeman and Co, London.

Laboratory Course –III

Syllabus:

Analysis of Inorganic SIMPLE SALT **50 M**

Analysis of simple salt containing ONE anion and ONE cation from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate and Phosphate

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium Magnesium and Ammonium

1. A Text Book of Quantitative Inorganic Analysis - Vogel, A. I.
2. A Textbook of Elementary Qualitative Analysis. Third edition (Engelder, Carl J.)
3. Systematic Qualitative Analysis. K L Kapoor.

Web Links:

1. https://youtu.be/adA8doZhqWs

SEMESTER – IV

COURSE - IV

Syllabus:

UNIT –I Chemistry of p-block elements – I **9 h**

Group 13: Preparation & structure of Diborane, Borazine and (BN)x

Group14: Preparation, classification and uses of silicones and Silanes.

Group 15: Preparation & structure of Phosphonitrilic Chloride $P_3N_3Cl_6$

Unit II Chemistry of p-block elements – II **9 h**

Group 16: Classification of Oxides, structures of oxides and Oxoacids of Sulphur

Group 17: Preparation and Structures of Interhalogen compounds. Pseudo halogens.

UNIT-III Chemistry of d-block elements: **9 h**

Characteristics of d-block elements with special reference to electronic configuration, variable valence color, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states of 3d series-Latimer diagrams.

UNIT-IV Chemistry of f-block elements: **9 h**

Chemistry of lanthanides - electronic configuration, oxidation states, lanthanide contraction, consequences of lanthanide contraction, color, magnetic properties. Separation of lanthanides by ion exchange method. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

Unit – V Radioactivity **9 h**

Definition, Isotopes, n/p ratio, binding energy, types of radioactivity, Soddy-Fajan's

displacement law, Law of Radioactivity, Radioactive decay series, Nuclear Reactions

fission and fusion, Applications of radioactivity

Additional inputs: Carbides, Silicates, Zeolites, Oxyacids of Phosphorous, Classification of Interhalogen Compounds, Frost Diagrams, Comparison between d and f Block elements, Applications of radioactive elements in Cancer therapy.

List of Reference Books:

1. Inorganic Chemistry by J.E.Huheey
2. Basic Inorganic Chemistry by Cotton and Wilkinson
3. A textbook of qualitative inorganic analysis by A.I. Vogel 4. Concise Inorganic

Laboratory Course - IV

Syllabus:

Preparation of Inorganic compounds **50 M**

Preparation of following Inorganic compounds:

1. Crystallization of compounds and determination of melting point.
2. Preparation of Cuprous chloride.
3. Preparation of Potash Alum.
4. Preparation of Chrome Alum.
5. Preparation of Ferrous oxalate
6. Preparation of Ferrous ammonium sulphate.

Reference books:

1. Vogel's Quanlitative Inorganic Analysis, Seventh edition, Pearson.

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA
SECOND YEAR, SEMESTER– III
Course Code 5: FUNDAMENTALS IN ORGANIC CHEMISTRY 45 h (3h / w)

Syllabus:

Unit I. Structural theory in Organic Chemistry (9 h)

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents). Reaction intermediates – Carbocations, carbanions & free radicals. Bond polarization: Factors influencing the polarization of covalent bonds, inductive effect - Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes.

Unit II. Saturated Hydrocarbons (Alkanes and Cycloalkanes) (9 h)

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane), General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT-III. Unsaturated Hydrocarbons (Alkenes and Alkynes) 9 h

General methods of preparation, physical and chemical properties, Saytzeff and Hoffmann eliminations (with mechanism), Electrophilic Additions, (X_2, HX) mechanism (Markownikoff/ Antimarkownikoff addition) with suitable examples-syn and anti-addition; addition of X_2, HX. Oxymercuration demercuration, ozonolysis, hydroxylation, Diels Alder reaction, 1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT-IV. Benzene and its reactivity (9 h)

Structure of Benzene – Preparation - polymerization of acetylene and decarboxylation Properties - mechanism of electrophilic aromatic substitution of Friedel- Craft's alkylation and acylation, halogenation and nitration.

UNIT-V. Orientation of aromatic substitution (9 h)

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropylium cation) Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO2 and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens.

Additional Inputs:

Electromeric effect, Stability of resonating structures**,** Functional groups: Hydroxy(-OH), Carboxyl(C=O), Amino(-NH2)**,** Alkanes -Structure, Nomenclature and isomerism, Newman Projections, Applications and of Alkenes and Alkynes, Physical Properties of benzene: Physical State, Boiling Point, Melting Point, Density, Solubility, Substitution patterns of Multiple Substituents.

II. List of Reference Books

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (PearsonEducation).

2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

3. Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition,1985

SEMESTER – IV
COURSE -VI

Syllabus:

Unit – I: Halogen compounds (9 h)

Alkyl halides: Preparation of alkyl halides from i) alkanes, ii) alkenes and iii) alcohols. Properties - nucleophilic substitution reactions–SN^1 and SN^2 mechanisms with energyprofile diagrams and stereo chemical aspects . Williamson's synthesis.

Aryl halides: Preparation i) from phenols ii) Sandmeyer's reaction, nucleophilic aromatic substitution (Benzyne mechanism); relative reactivity of alkyl, allyl, vinyl and benzyl, aryl halides towards nucleophilic substitution reactions.

Unit II:Alcohols and Phenols (9 h)

Alcohols: Nomenclature,classification, Preparation of 10,20,30alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties –A) Reactions involving only the hydrogen atom of -OH group B) Reactions involving -OH group as a whole. Distinction between 10,20,30alcohols with lucas reagent. Pinacol Pinacolone arrangement with mechanism

Phenols :Preparation from diazonium salt and Cumene. Reactions and mechanism–Reimer–Tiemann, Kolbe–Schmitt Reactions, Fries and Claisen rearrangements

Unit III: Carbonyl Compounds (9 h)

Preparation from-Acid chlorides,1,3-dithiane and nitriles; Structure and reactivity of carbonyl group, Nucleophilic addition reactions with HCN, $NaHSO_3$ and alcohols. addition-elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4DNP, semicarbazide. Oxidations and reductions (Baeyer -Villiger oxidation,$KMnO_4$, Clemmensen's,Wolf–Kishner's, with $LiAlH_4$ & $NaBH_4$).

Reaction & Mechanism- Aldol condensation, Cannizzaro reaction, Perkin reaction, Benzoin condensation, Claisen-Schmidt reaction, Haloform reaction

Unit-IV: Carboxylic acid and Active methylene Compounds (9h)

Carboxylic Acids: Preparation from Grignard reagent and hydrolysis of nitriles, Reactions of monocarboxylic acids- Reactions involving -H, -OH and-COOH groups, formation of salts, esters, acidchlorides, amides and anhydrides. Degradation of carboxylic acids by Huns- Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis,halogenationby Hell- Volhard- Zelinsky reaction. Mechanisms

of acidic and alkaline hydrolysis of esters, Reformatsky reactions, Curtius rearrangement.

Active methylene compounds: Ketoenol tautomerism, preparation of Aceto Acetic Ester(AAE) by Claisen condensation with mechanism,synthetic applications of AAE in the preparation of mono carboxylic acids, di carboxylic acids, α,β-unsaturated acids and heterocyclic compounds.

Unit V : Carbohydrates **(9 h)**

Classification and their biological importance, Monosaccharides: Structural elucidation of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation.

Additional inputs:

Classification and Nomenclature of Alkyl Aryl and Aryl Alkyl Halides, Identification of Alcohols Distinguish between Alcohols & Phenols, Acidic Character of Phenol, Reaction of Carbonyl Compounds with Grignard Reagent, Differences between Aldehydes & Ketones, Acidity of Carboxylic Acids, Melonic Ester Synthesis, Differences between Glucose and Fructose.

List of Reference Books

1) 1.Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (PearsonEducation).

2) 2.Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).

3) Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition,1985.

LABORATORY COURSE – 6

Syllabus - Organic preparations (50M)

1. Acetylation of phenols (β-naphthol, vanillin, salicylic acid) by any one method:
   a. Using conventional method.
   b. Using green approach
   2. Preparation of Nerolin
   3. Preparation of phthalic anhydride from phthalic acid
   4. Preparation of phthalimide from phthalic anhydride
   5. Preparation of Phenolphthalein indicator and test its color change.
   6. Synthesis of fluorescent yellow.

Reference books:

1. Vogel A.I .Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry,University press

SEMESTER – III

COURSE - 7

Syllabus:

Unit I: Solutions (9h)

Classification - Miscible, Partially miscible and Immiscible - Raoult's Law - Azeotropes- HCl-H_2O system and ethanol-water system. Partially miscible liquids-phenol- water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law**.**

Unit II: Colligative Properties (9 h)

Relative lowering of Vapour Pressure, Elevation in boing point depression in freezing point and Osmotic pressure. Determination of molecular mass of non-volatile solute by Ostwald-Walker method, Cottrell's method, Rast method and Barkeley-Hartley method.Abnormal colligative properties. Van't Hoff factor.

Unit III: Photochemistry (9h)

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, chemiluminescence - Photosensitized reactions-energy transfer processes (simple example), quenching, Photo stationary state.

Unit IV:Electrochemistry-I (9 h)

Conductance, Specific conductance, equivalent conductance and molar conductance - effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications. Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel - Onsagar's equation for strong electrolytes (derivation excluded), Application of conductivity measurements- conductometric titrations.

Unit V:Electrochemistry-II (9 h)

Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal-metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements-Potentiometric titrations. Fuelcells – Basic concepts, examples and applications.

Additional Inputs

Henry's law and limitations, examples for systems with lower and upper CST, limitations of distribution law, Derivation of relation between molecular weight of solute and elevation boiling

point, depreesion freezing point. Defintions Kf and Kb,Principles of photochemistry, Beer- Lambert law,Arheniuos theory, Oswald's dilution law, Debye Huckel theory of strong electrolytes,Reversible and irreversible cells .

List of Reference books:

1) Principles of physical chemistry by Prutton and Marron

2) Solid State Chemistry and its applications by Anthony R. West

3) Text book of physical chemistry by K L Kapoor

4) Text book of physical chemistry by S Glasstone

5) Advanced physical chemistry by Bahl and Tuli

6) Advanced physical chemistry by Gurudeep Raj

7) Principles of physical chemistry by Puri, Sharma and Pathania.

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS)
KAKINADA
LABORATORY COURSE III - SEMESTER

COURSE CODE 7: PHYSICAL CHEMISTRY -I

CREDITS - 01
PHYSICAL CHEMISTRY

I. Course outcomes:

At the end of the course, the student will be able to:

1. Use of glassware, equipment and chemicals and follow experimental procedures in the laboratory.
2. Understand and apply the concepts of solutions practically.
3. Apply concepts of electrochemistry in experiments.

II. Syllabus:

CST, Conductometric and Potentiometric Titrimetry **50 M**

1. Determination of CST for Phenol-water system.
2. Effect of electrolyte on CST.
3. Conductometric titration - Determination of concentration of HCl solution using standard NaOH solution.
4. Conductometric titration – Determination of concentration of CH_3COOH Solution using standard NaOH solution.
5. Potentiometric titration-Determination of concentration of HCl using standard NaOH solution.

III. List of reference books:

1) A Text Book of Quantitative Inorganic Analysis(3^{rd}Edition) –A.I.Vogel

2) Web related references suggested by teacher.

SEMESTER – 3

COURSE -8

Syllabus:

Unit I Coordination Chemistry-I (9 h)

IUPAC nomenclature of Coordination compounds, structural and stereo isomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory(VBT): Postulates-magnetic properties- Inner and outer orbital complexes. Limitations of VBT, CFT-Postulates- Splitting in Octahedral, tetrahedral, tetragonal and square planar fields. Crystal field stabilization energy(CFSE), Crystal field effects for weak and strong fields. Factors affecting the magnitude of crystal field splitting energy, Spectro chemical series, Tetragonal distortion of octahedral geometry**, Jahn-Teller distortion.**

UNIT–II Coordination Chemistry II (9 h)

1. Inorganic molecular Reaction Mechanism: (6 h)

Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions – SN^1 and SN^2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications.

2.Stability of metal complexes: (3 h)

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

Unit III Organometallic compounds (9 h)

Definition and classification of organo metallic Compounds on the basis of bond type, Metalcarbonyls: 18electron rule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. π-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Unit IV:Thermodynamics- I (9 h)

Concept of heat(q), work(w), internal energy(U), State function and Path function-statement of first law; enthalpy(H), relation between heat capacities, calculations of q, w, U and H for reversible, irreversible processes, Joule-Thomson effect- coefficient,

Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes. Temperature dependence of enthalpy of formation- Kirchoff's equation.

Unit V Thermodynamics II **(9 h)**

Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs equation - Criteria for spontaneity.

Additional inputs:

Werner theory, Calculation of CFSE for weak and strong field ligands, stability of complexes, Electrophilic substitution of complex compounds, Applications of Cisplatin in Cancer therapy and its side effects, EAN, Applications of Organo metallic compounds in Catalysis, Maximum work done in reversible isothermal expansion of an ideal gas, Relation between P, V and T in adiabatic process.

List of Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London,1996.
2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry,Shoban Lal NaginChand and Co., 1996.
3. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3 rd ed., W. H. Freeman and Co,London,

LABORATORY COURSE -8

Syllabus

Analysis of Inorganic SIMPLE SALT **50 M**

Analysis of simple salt containing TWO anions and TWO cations (from two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate and Phosphate
Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium,Barium, Magnesium and Ammonium

References:

1. A Text Book of Quantitative Inorganic Analysis - Vogel, A. I.
2. A Textbook of Elementary Qualitative Analysis. Third edition (Engelder, Carl J.)

SEMESTER – IV

COURSE – 9

Syllabus:

Unit I - Gaseous state (9 h)

Postulates of Kinetic theory of Gases (exclude derivation) – deduction of gas laws from kinetic gas equation-Vander Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Law of corresponding states. Joule- Thomson effect. Inversion temperature.

Unit II – Liquid State (9 h)

Physical properties of liquids: vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water.

Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

UNIT-III - Solid state (9h)

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law and its derivation. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

Unit IV - Phase Rule (9 h)

The Concept of phase, components, degrees of freedom. Gibbs phase rule. Phase diagram of one component system – water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point, freezing mixtures .

Unit V- Surface Chemistry (9 h)

Definition and classification of Colloids- Coagulation of colloids- Hardy-Schulze rule.
Stability of colloids, Protection of Colloids, Gold number.
Adsorption - Physical and chemical adsorption, Freundlich and Langmuir adsorption isotherm, applications of adsorption.

Additional Inputs:

1. Physical Properties: Shape and Volume,Compressibility,Density,Diffusion
2. Kinetic Molecular theory:Particles, Negligible Volume, No Intermolecular forces, Elastic Collisions, Average Kinetic Energy.

3. Properties of Liquids: Viscosity, Surface tension, Capillarity, Density
4. Phase Transitions: Melting, Freezing, Boiling, Condensation.
5. Properties of Solids: Rigidity, Density, Elasticity, Hardness, Thermal Conductivity, Electrical Conductuvity
6. Phase transitions.
7. Significance of phase rule
8. Practical applications: Material Science, Chemical Engineering, Geology, Pharmaceuticals.
9. Techniques for studying surfaces: Spectroscopy, Microscopy, Surface area Management.

List of Reference Books:

1) Solid State Chemistry and its applications by Anthony R. West

2) Text book of physical chemistry by K L Kapoor Vol.1

3) Text book of physical chemistry by S Glasstone

4) Advanced physical chemistry by Bahl and Tuli.

IV - SEMESTER

Course Code 9: Physical Chemistry

Course outcomes:

At the end of the course, the student will be able to:

1) Use glassware, equipment and chemicals and follow experimental procedures in the laboratory

2) Apply concepts of surface chemistry in experiments.

3) Be familiar with the concepts & practical applications of Surface tension and viscosity of liquids.

Physical Chemistry Practical Syllabus:

1. Determination of surface tension of liquid by drop count method
2. Determination of surface tension of liquid by drop weight method
3. Determination of surface tension of mixture (liquid + detergent) using stalagmometer.
4. Determination of coefficient of viscosity of an organic liquid.
5. Determination of composition of a glycerol in glycerol + water mixture using viscometer.
6. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

SEMESTER -IV
COURSE -10

Syllabus:

UNIT-I Stereo chemistry of carbon compounds (9 h)

Molecular representations - Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

Unit II Bioinorganic Chemistry (9 h)

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Na / K- pump, carbonic anhydrase and carboxy peptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cisplatin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin-transfer of oxygen, Myoglobin-Storage and transfer of iron.

Unit III Ionic equilibrium (9 h)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, Buffer solutions-Henderson's equation. Indicators-theories of acid – base Indicators, selection of Indicators,Common ion effect Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Unit IV Chemical Kinetics-I: (9 h)

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (similar and different reactants). Half–life of a reaction. General methods for determination of order of a reaction.

Unit V Chemical Kinetics-II: (9 h)

Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Enzyme catalysis- Specificity, factors affecting enzyme catalysis, Inhibitors and Lock & key

model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

Additional Inputs

Concept of symmetry, D, L & R and S notation, Structures and functions of Haemoglobin and Myoglobin, Indicators used in Complexometric titrations and redox titrations, Differences between order and molecularity of a reaction, Third order rate equation derivation, Homogeneous and heterogeneous catalysts.

Reference books

1) Text book of physical chemistry by S Glasstone
2) Concise Inorganic Chemistry by J.D.Lee
3) Advanced physical chemistry by Gurudeep Raj
4) Advanced physical chemistry by Bahl and Tuli
5) Inorganic Chemistry by J.E.Huheey
6) Basic Inorganic Chemistry by Cotton and Wilkinson.

LABORATORY COURSE -10

Syllabus:

Volumetric Analysis:

1. Estimation of sodium hydroxide using standardised HCl solution.

2. Estimation of sodium carbonate and sodium hydroxide present in a mixture.

3. Determination of Fe (II) using $KMnO_4$ with oxalic acid as primary standard. (internal indicator method)
4. Determination of Fe (II) using $KMnO_4$ with oxalic acid as primary standard. (external indicator method)
5. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$

II. List of reference books:

1. A Text Book of Quantitative Inorganic Analysis(3^{rd}Edition) –A.I.Vogel

2. Web related references suggested by teacher.

SEMESTER – IV

COURSE - 11

Syllabus:

Unit I Amines: (9 h)

Classification, chirality in amines (pyramidal inversion), preparations – Gabriel synthesis,

Hoffmann- Bromamide reaction (with mechanism), reduction of amides and Schmidt reaction. Distinction between Primary, secondary and tertiary amines using Hinsberg's method and nitrous acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Carbylamine reaction, Hoffmann's exhaustive methylation, Hofmann and Cope elimination.

Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitro compounds. Coupling reactions ofdiazonium salts (preparation of azo dyes).

UNIT- II Amino acids (9 h)

Definition and classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: a) from halogenated carboxylic acid, b) Gabriel Phthalimide synthesis c) Strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

UNIT- III Nitro hydrocarbons (9h)

Nomenclature and classification, structure -Tautomerism of nitroalkanes leading to acid and keto form, Preparation of Nitroalkanes, reactivity - halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

Unit IV Heterocyclic Compounds (9 h)

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex.Furan, Thiophene and Pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation - Diels Alder reaction in furan. Pyridine – synthesis - Aromaticity -Basicity - Comparison with pyrrole-one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

Unit V- UV Visible & IR Spectroscopy (9 h)

Selection rules for electronic spectra, types of electronic transitions in molecules, concept of chromophore and auxochrome, effect of conjugation- Woodward Fischer rules for calculating

λ_{max} of conjugated dienes and, unsaturated compounds. Infrared spectroscopy and types of molecular vibrations and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intra molecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Additional Inputs

Functional Group transformations involving Amines such as Oxidation to Nitro Compounds, Alkylation, acylation, Biological importance of aminoacids, Role of Nitrohydro Compounds in drug design and development,Comparison of Aromatic character of Furan, Thiophene, Pyrrole and Pyridine, Hyperchromic Shift and Hypochromic Shift, Applications of UV & IR Spectroscopy.

LABORATORY COURSE -11

Syllabus:

A. Organic preparations **25M**

1) Acetylation of one of the following compounds: amines (aniline, o-, m-, ptoluidinesand o-, m-, p-anisidine)
    a. Using conventional method.
    b. Using green approach
2) Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-,p-anisidine)
3) Nitration of any one of the following:
   Acetanilide/nitrobenzene by conventional method
4) Nitration of Salicylic acid by green approach (using calcium nitrate and acetic acid).
5) Preparation of 1-phenylazo β-naphthol by diazotization and coupling with β-naphthol

B.*IR Spectral Analysis* *10M*

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups b)Carbonyl groups c) Amino groups d) Aromatic groups

List of reference books:

1. Vogel A.I .Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry,University press.
4. Web related references suggested by teacher.

	A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS), KAKINADA	Program & Semester II B.Sc. CHEMISTRY (H)SEMESTER - V				
Course Code Major-11	TITLE OF THE COURSE **Paper 6 - D (ENVIRONMENTAL CHEMISTRY)**					
Teaching	Hours Allocated:60 (**Theory**) (4hrs. / Wk.)	L	T	P	C	
Pre-requisites:	Basic knowledge about inorganic chemistry and elements	4	-	-	5	

II Syllabus :

UNIT-I: Introduction **12 h**

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in nowadays – Nomenclature of environmental chemistry – Segments of environment– Effects of human activities on environment – Natural resources–Renewable Resources–Solar and biomass energy and Nonrenewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydro logical cycle.

UNIT-II: Air Pollution **12 h**

Definition – Sources of air pollution – Classification of air pollution – Ambient air quality standards- Climate change – Global warming – Pollution from combustion systems- Acid rain – Photochemical smog – Greenhouse effect – Formation and depletion of ozone – Bhopal gas disaster–Instrumental techniques to monitor pollution – Controlling methods of air pollution.

UNIT-III: Water pollution **12 h**

Unique physical and chemical properties of water – Water quality standards and parameters – Turbidity- pH Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity– Hardness of water–Methods to convert temporary hard water in to soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects – Industrial waste water treatment.

UNIT-IV: Chemical Toxicology **12 h**

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium- Solid

waste management.

UNIT-V: Ecosystem and biodiversity **12 h**

Ecosystem

Concepts–structure–Functions and types of ecosystem–Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem– Food chains – Food web– Tropic levels– Biogeochemical cycles (carbon, nitrogen and phosphorus)

Biodiversity: Definition – level and types of biodiversity – concept- significance – magnitude and distribution of biodiversity–trends-bio geographical classification of India–biodiversity at national, global and regional level.

Additional inputs: Water cycl, Climate change,Ozone Depletion Substances, Responsibility of individual in protecting Ozone layer, Drinking Water Parameters-Indian Standards, Methods and Tools used in Chemical Toxicology,Carbon inputs to Ecosystem, Effect of pollutants on ecosystem and human health.

III. List of Reference books:

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k.Banerji
4. Water pollution, Lalude, MC Graw Hill
5. Environmental Chemistry, Anil Kumar De, Wiley Eastern ltd.
6. Environmental analysis, SM Khopkar (IIT Bombay)
7. Environmental Chemistry by BK Sharma & H Kaur, Goel publishing house.
8. Fundamentals of Environmental Chemistry, Manahan, Stanley. E
9. Applications of Environmental Chemistry, Eugene R. Wiener

Web Links: **:**

1. https://youtu.be/zph2PxDNH8g
2. https://youtu.be/IX4cT6sSa3s

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA
DEPARTMENT OF CHEMISTRY
THIRD YEAR, SEMESTER– V
Course 6-D: Environmental Chemistry – Practical syllabus

IV. Lab work-Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Chemistry lab.
2. Learn the procedures of preparation of standard solutions.
3. Demonstrate skills in operating instruments.
4. Acquire skills in handling spectrophotometer.
5. Analyse water and soil samples.

V. Practical (Laboratory) Syllabus: (**30 h**) (Max.40 M).

1. Identification of various equipment in the laboratory.
2. Determination of carbonate and bicarbonate in water samples by double titration method.
3. Determination of hardness of water using EDTA

a) Permanent hardness b) Temporary hardness

4. Determination of Chlorides in water samples by Mohr's method.
5. Determination of pH in water sample using pH metry and Total dissolved Substance (TDS) of Water.
6. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
7. Determination of PH in soil samples using pH metry.
8. Determination of Conductivity of Water by Conductimetry.

Reference books:

1. Practical hand book of Water analysis by Kanwaljit kaur
2. Volumetric analysis by Mc grew-Hill
3. Volumetric analysis by Henry W.Schimpf

Web links:

1. https://youtu.be/Set3XdRshGo
2. https://youtu.be/zXvEmlFqicw
3. https://youtu.be/OiWMSopuuLU

	A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS), KAKINADA	Program & Semester II B.Sc. CHEMISTRY(H) SEMESTER-V				
Course Code Major-11	TITLE OF THE COURSE **Paper 7 - D (GREEN CHEMISTRY AND NANOTECHNOLOGY)**					
Teaching	Hours Allocated: 60 (**Theory**) 4 hrs. / Wk.)	L	T	P	C	
Pre -requisites:	Basic knowledge about inorganicchemistry and elements	4	-	-	5	

Syllabus:

UNIT-I Green Chemistry: Part- I 12 hrs

Introduction-Definition of green Chemistry, Need for green chemistry, Goals of Green chemistry Basic principles of green chemistry. Green synthesis- Evaluation of the type of the reaction

i) Rearrangements (100% atom economic), ii) Addition reaction (100% atom economic). Organic reactions by Sonication method: apparatus required and examples of sonochemical reactions (Heck, Hundsdicker and Wittig reactions).

UNIT- II Green Chemistry: Part- II 12 hrs

A) Selection of solvent:

i) Aqueous phase reactions

ii) Reactions in ionic liquids, Heck reaction, Suzuki reactions, epoxidation.

iii) Solid supported synthesis

B) Supercritical CO2: Preparation, properties and applications, (decaffeination, drycleaning)

C) Green energy and sustainability.

UNIT-III Microwave and Ultrasound assisted green synthesis: 10 hrs

Apparatus required, examples of MAOS (synthesis of fused anthraquinones, Leukart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldol condensation –Cannizzaro reaction- Diels-Alder reactions-Strecker's synthesis

UNIT-IV Green catalysis and Green synthesis 14 hrs.

Heterogeneous catalysis, use of zeolites, silica, alumina, supported catalysis - bio catalysis:Enzymes, microbes Phase transfer catalysis (micellar /surfactant)

1. Green synthesis of the following compounds: adipic acid, catechol, disodium menudo acetate(alternative Strecker's synthesis)
2. Microwave assisted reaction in water –Hoffmann elimination – methyl benzoate to benzoic acid –oxidation of toluene and alcohols–microwave assisted reactions in organic solvents. Diels-Alder reactions and decarboxylation reaction.
3. Ultrasound assisted reactions–sonochemical Simmons–Smith reaction (ultrasonic alternative to iodine)

UNIT – V Nanotechnology in Green chemistry 12 hrs

Basic concepts of Nano science and Nanotechnology – Bottom-up approach and Top down approaches with examples – Synthesis of Nano materials – Classification of Nanomaterial – Properties and Application of Nanomaterial. Chemical and Physical properties of Nanoparticles – Physical synthesis of nanoparticles – Inert gas condensation - aerosol method - Chemical Synthesis of nanoparticles – precipitation and co-precipitation method, sol-gel method.

Additional inputs: Wurtz Reaction, Diels-Alder reaction, Sigmatropic rearrangements (100% atom economic) Solvent Selection, Sonochemical Michael addition, Recent Advances in Microwave and Ultrasound Assisted Green Synthesis, Applying Novel technology in Microwave Synthesis, Advances of nanotechnology, Advantages of Green Synthesis of Nanoparticles.

III. Reference books:

1. Green Chemistry Theory and Practical. P.T.Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Principles and practice of heterogeneous catalysis, Thomas J.M.,Thomas M.J., John Wiley
6. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M Srivastava,Narosa Publications
7. Nanotechnology: Health and Environmental Risks, Jo Anne Shatkin, CRC Press (2008).

A.S.D. GOVERNMENT DEGREE COLLEGE FOR WOMEN (A), KAKINADA
DEPARTMENT OF CHEMISTRY
THIRD YEAR, SEMESTER– V
Paper 7 - D (GREEN CHEMISTRY AND NANOTECHNOLOGY) PRACTICAL

Lab work - Skills Outcomes:

On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in the laboratory.
2. Learn the advantages of green synthesis over conventional synthesis.
3. Learn procedures of green synthesis.
4. Demonstrate skills in the preparation of Nanomaterials.
5. Acquire skills in Microwave assisted organic synthesis.
6. Perform some applications of Nanomaterials.

Practical (Laboratory) Syllabus: (30 hrs.) (Max.40 Marks)

1. Identification of various equipment in the laboratory.
2. Acetylation of 1^0 amine by green method: Preparation of acetanilide.
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement.
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol.
5. Green oxidation reaction: Synthesis of adipicacid.
6. Preparation of biodiesel from vegetable oil/ waste cooking oil.
7. Preparation and characterization of Nanoparticles of gold using tea leaves.
8. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
9. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.
10. Preparation of Nanoparticles of Copper/ SILVER/ Iron using *Aloe barbedensis /Azadirachta indica*.
11. Diels-Alder reaction between Furan and Maleic acid/ Maleic anhydride.