ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

II SEMESTER B.Sc., HONOURS CHEMISTRY: MAJOR Time:3 Hrs/Week

Code: CH-Ma1-2201(3) SYLLABUS Max. Marks: 100

GENERAL AND INORGANIC CHEMISTRY

Credits: 3

23-24 admitted batch

Course Objectives: The objective of the course is

- ✔ To enable students to comprehend and apply the fundamental concepts pertaining to atomic structure, periodic classification, chemical bonds and acids & bases

Course Outcomes: At the end of the course the student will be able to-

- **CO1:** Explain the structure of atom and arrange elements in the modern periodic table.
- **CO2**: Correlate the properties properties of ionic compounds to the nature of binding force.
- **CO3:** Establish the structure of a given covalent compound based on hybridization.
- **CO4:** Identify the existence of weak binding forces in the form of non-bonding interactions.
- **CO5**:Apply HSAB principle to acids and bases and predict the behavior of salts.

Syllabus:

Unit I: Atomic Structure and Periodic table (9 h)

Electronic configuration: Bohr theory, duel nature of electrons, Heisenberg uncertainty principle, the Schrodinger equation, significance of wave functions, normalization of wave function, radial and angular wave functions, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).

Periodicity: periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number, horizontal, vertical, and diagonal relationships in the periodic table. 1.3 General properties of atoms: size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect;

UNIT 2: Ionic bond (9 h)

Properties of ionic compounds, factors favouring 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 $\Delta H_f$and Uo. Solubility and thermal stability of ionic compounds. Covalent character in ionic compounds-polarization and Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.

UNIT 3: The Covalent Bond (9 h)

Valance Bond theory-arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules-BeCl2, BF3, CH4, PCl5, SF6– VSEPR model-effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity, isoelectronic principle, illustration of structures by VESPR model-NH3, H2O, SF_6, ICl_4^- , ICl_2^-, SF_4, SF_6

Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N2, O2, CO and NO)

UNIT 4: 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; Vanderwaals forces, ion dipole-dipole interactions.

UNIT 5: 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 andSoft-Soft combinations.

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, 3rd ed., W. H. Freeman and Co, London,

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

II SEMESTER B.Sc., HONOURS CHEMISTRY: MAJOR Time: 2Hrs/Week

Code-CH-Ma1-2251(2) SYLLABUS Max. Marks: 50

Credits: 2

GENERAL AND INORGANIC CHEMISTRY

23-24 admitted batch

Practical- I Qualitative Analysis of SIMPLE SALT

Qualitative inorganic analysis (Minimum of Six simple salts should be analysed) 50 M

Course Objective:

- ✔ To train students in the systematic semi-micro analysis of simple salts containing one anion and one cation.

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

- **CO1:** Understand the basic concepts of qualitative analysis of inorganic simple salt.
- **CO2:** Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
- **CO3:** Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

Laboratory course syllabus:

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

Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning.
2. Class Tests, Work sheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality

Reference books:

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

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),

VISAKHAPATNAM

II SEMESTER B.Sc., HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week

Code: CH-Ma2-2201(3) SYLLABUS Max Marks: 100

Course Code: INORGANIC CHEMISTRY- I

Credits: 3

w.e.f 23-24 admitted batch

Course Objectives:

- ✔ To enable students to understand and apply concepts pertaining to the classification, properties and uses of p, d and f block elements along with the preparation methods and applications of selected compounds of these elements.

Course outcomes:

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

- **CO1**. Explain the preparation, properties and structure of p-block elements and their compounds.
- **CO2.** Correlate the properties of d-block elements and coordination compounds to the electronic arrangement in them.
- **CO3.** Distinguish between the properties of lanthanides and actinides.
- **CO4**. Enlist the applications of f block elements & their compounds.
- **CO5**. Describe and evaluate the importance of radioactivity.

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. Pseudohalogens,

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

Characteristics of d-block elements with special reference to electronic configuration, variable valence, colour, 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, colour, magnetic properties.

Separation of lathanides 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.

List of Reference books:

1. Basic Inorganic Chemistry by Cotton and Wilkinson

2. Advance Inorganic chemistry vol-I by Satya Prakash

3. Inorganic chemistry by Puri and Sharma

4. Concise Inorganic Chemistry by J D Lee

5. Nuclear Chemistry by Maheshwar Sharon, 2009

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

II SEMESTER **B.Sc., HONOURS CHEMISTRY: MAJOR** **Time: 2Hrs/Week**

Code: CH-Ma2-2251(2) **SYLLABUS** **Max. Marks: 50**

Course Code 4: INORGANIC CHEMISTRY- I

Credits: 02

w.e.f :23-24 admitted batch

Course Objective:

- ✔ To train students in the systematic preparation of selected simple and double salts.

Course outcomes:

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

- **CO1.** Prepare simple and double salts in accordance with the systematic procedures.
- **CO2.** Use glassware, equipment and chemicals in accordance with the experimental protocolss in the laboratory
- **CO3.** Determine the yield of the compound.

Syllabus:

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.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR/MINOR Time: 3Hrs/Week

Code: CH-Ma1-3201 SYLLABUS Max. Marks: 100

FUNDAMENTALS IN ORGANIC CHEMISTRY

Credits: 03

Course Objective: The objective of the course is to introduce the fundamental aspects of chemistry pertaining to the structure, properties and reactivity of aliphatic and aromatic hydrocarbons, to students.

Course Outcomes: By the end of the course, the student will be able to

1. Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt
2. Explain the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved
3. Sketch organic reaction mechanisms and
4. Correlate the stereo-chemical properties of organic compounds to their structure and functional groups and
5. Identify the conditions necessary for aromaticity and examine the orientating influence of the substituents on aromatic rings.

Syllabus:

Unit 1. 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, (H_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 - polymerisation 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 NO_2 and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens.

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).

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER B.Sc., HONOURS CHEMISTRY: MAJOR/MINOR Time: 2Hrs/Week

Code: CH-Ma1-3251 SYLLABUS Max. Marks: 50

Organic Qualitative Analysis Credits: 02

Course Objective: The objective of the course is

- ✔ to train the students in qualitative organic analysis leading to the identification of the organic compound.

Course Outcomes:

By the end of the course, the student will be able to;

- CO1: Use glassware, equipment and chemicals and follow experimental protocols in the laboratory
- CO2: Determine melting and boiling points of organic compounds
- CO3: Apply theoretical concepts of organic chemistry for identification and derivatization of functional group and
- CO4: Identify the unknown organic compound

Syllabus:

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives. Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars.

Co-curricular activities and Assessment Methods

- Continuous Evaluation: Monitoring the progress of student's learning
- Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
- SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER .

Reference books:

1. Vogel A.I .Practical Organic Chemistry, Longman Group

2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.

3.Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry, University pre

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week

Code: CH-Ma2-3201 SYLLABUS Max. Marks: 100

ORGANIC CHEMISTRY

(Halogen and Oxygen Containing Organic Compounds)

Credits: 03

Course Objective: The objective of the course is to introduce the students to

- ✔ the structure, properties and reactivity of aliphatic and aromatic halogenated hydrocarbons, alcohols, carbonyl compounds, carboxylic acids and acid derivatives

Course outcomes: By the end of the course, the student will be able to:

- CO1: Correlate SN_1, SN_2 and SN_i mechanisms to nucleophilic substitution reactions in alkyl halides & alcohols
- CO2: Describe the reactivity of alcohols and phenols
- CO3: Sketch the mechanistic pathways for selected named reactions of carbonyl compounds
  CO4: Identify the synthetic applications of carboxylic acids & their derivatives and
- CO5: Design pathways for the interconversion of monosaccharides.

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 and SN_i mechanisms with energy profile diagrams, stereo chemical aspects and effect of solvent. 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: Preparation of 1^0,2^0,3^0alcohols from Grignard's reagent, Bouveault–Blanc Reduction; Chemical properties – substitution of –OH by using PCl5, PCl3, PBr3, SOCl2 and with HX / ZnCl2, Oxidation of alcohols with PCC, PDC; Oxidation of diols by HIO4 and Pb(OAc)4, Pinacol Pinacolone arrangement with mechanism, relative reactivity of 1°, 2°, 3°alcohols.

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

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, NaHSO3 and alcohols. addition-elimination reactions with hydroxylamine, hydrazine, phenyl hydrazine, 2,4DNP, semicarbazide. Oxidations and reductions (Clemmensen's, Wolf–Kishner's, withLiAlH4 & NaBH4).
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-COOHgroups, formation of salts, esters, acidchlorides, amides and anhydrides. Degradation of carboxylic acids by Huns- Diecker's reaction, decarboxylation by Schmidt reaction, Arndt-Eistert synthesis, halogenation by 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; Disaccharides– Haworth structure of maltose, lactose and sucrose.

II. List of Reference Books

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

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER **B.Sc HONOURS CHEMISTRY: MAJOR** **Time: 2Hrs/Week**

Code : CH-Ma2-3251 **SYLLABUS** **Max. Marks: 50**

Organic Preparations **Credits: 02**

Course Objective: The objective of the course is to train the students in the skill of organic synthesis by the conventional and green techniques.

Course outcomes:

On the completion of the course, the student will be able to

1. Effectively use glassware, equipment and chemicals and follow experimental protocols in the laboratory.
2. Synthesize organic compounds by the conventional and green methods.
3. Perform common laboratory procedures including reflux, distillation, recrystallization, vacuum filtration etc.
4. Critically evaluate data to determine the identity and percent yield of products and summarize the findings.

Syllabus - Organic preparations (50M)

i. Acetylation of β-naphthol, vanillin and salicylic acid by:

   a) Using conventional method.
   b) Using green approach

ii.Preparation of Nerolin

Co-curricular activities and Assessment Methods;

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions:
4. Enhances critical thinking skills and personality
5. SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER

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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.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week

Code CH-Ma3-3201(3) SYLLABUS Max. Marks: 100

Credits: 03

PHYSICAL CHEMISTRY – I

(Solutions & Electro Chemistry)

Course Objective: The objective of the course is to teach the chemistry students the theoretical aspects pertaining to the types of solutions, colligative properties, photochemistry and electrochemistry.

Course outcomes: By the end of the course, the student will be able to

1. Understand the behavior of ideal and non-ideal solutions.
2. Determine the molecular mass of non-volatile solutes.
3. Deduce the quantum yield of Photochemical processes
4. Apply the principles of electrical conductivity and
5. Comprehend the applications of emf.

Syllabus:

Unit I Solutions (9 h)

Classification - Miscible, Partially miscible and Immiscible - Raoult's Law - Azeotropes- HCl-H2O 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 photochemistryGrothus- 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.

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.

III SEMESTER

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 2Hrs/Week

Code: CH Ma3 3251(2) SYLLABUS Max. Marks: 50

PHYSICAL CHEMISTRY

Credits: 02

PHYSICAL CHEMISTRY

Course Objective: The objective of the course is to train the chemistry students in titrimetric and instrumental methods of analysis.

Course outcomes: By the end of the course, the student will be able to:

1. Optimally use glassware, equipment and chemicals and follow experimental protocols in the laboratory.
2. Determine CST and study the effect of electrolyte on CST and
3. Apply the concepts of electrochemistry and perform experiments.

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.

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.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week

Code: CH-Ma4-3201(3) SYLLABUS Max. Marks: 100

COURSE CODE 8: INORGANIC AND PHYSICAL CHEMISTRY

Credits: 03

Course Objective: The objective of the course is to teach students the structure, nomenclature, isomerism and reactivity of coordination compounds along with the principles and applications of thermodynamics

Course Outcomes: By the end of the course, the student will be able to

1) Name Coordination compounds by applying IUPAC rules
2) comprehend the theories on coordination compounds
3) Explain the reaction mechanism in complex compounds
4) Correlate the stability of coordination compounds to the 18-electron rule and
5) Summarize the laws and applications of thermodynamics.

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 Organo metallic 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.

II. List of Reference Books:

1) Concise coordination chemistry by Gopalan and Ramalingam

2) Coordination Chemistry by Basalo and Johnson

3) Text book of physical chemistry by S Glasstone

4) Concise Inorganic Chemistry by J.D.Lee

5) Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan

6) A Text Book of Physical Chemistry by K.L.Kapoor Vol 2, 6^{th} edition, 2019.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 2Hrs/Week

Code: CH-Ma4-3251(3) SYLLABUS Max. Marks: 50

INORGANIC AND PHYSICAL CHEMISTRY

Course Objective: The objective of the course is to train the students in the skill of qualitative inorganic analysis at semi microlevel.

Course Outcomes:

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

1) Perform qualitative inorganic mixture analysis at the semimicro level.
2) Use glassware, equipment and chemicals and follow experimental laboratory protocols.
3) Apply the concepts of common ion effect, solubility product and eliminate interfering anions.

Analysis of Mixture 50M

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

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

Minimum of Six mixtures should be analyzed.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week

Code: CH-Ma1-4201(3) SYLLABUS Max. Marks: 100

PHYSICAL CHEMISTRY -II

(States of Matter, Phase Rule & Surface Chemistry)

Credits: 03

Course Objective: The objective of the course is to introduce the learners to the theories, concepts, principles and applications of the different states of matter, surface phenomena and phase equilibria

Course Outcomes: By the end of the Course, the student should be able to

1. Differentiate ideal and real gases and deduce gas laws from the kinetic gas equation
2. Explain the difference in the behavior of solids liquids and gases in terms of intermolecular interactions and thermal energy
3. Identify the stoichiometric and non-stoichiometric crystal defects
4. Determine the degrees of freedom in heterogenous equilibria based on Gibb's equation and
5. Apply the concepts of adsorption for surface phenomena

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.

II. 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.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 2Hrs/Week

Code: CH-Ma1-4251(2) SYLLABUS Max. Marks: 50

Physical chemistry Practical-II

Credits: 02

Course Objective: The objective of the course is to train students in the systematic procedure for the determination of certain physical constants pertaining to liquids

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

1) Use glassware, equipment and chemicals and follow experimental protocols in the laboratory
2) Determine the viscosity, surface tension and extent of adsorption and
3) Correlate the theoretical concepts with experimental observations.

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.

Co-curricular activities and Assessment Methods:

1) Continuous Evaluation: Monitoring the progress of student's learning
2) Class Tests, Worksheets and Quizzes
3) Presentations, Projects and Assignments and Group Discussions: Enhances

critical thinking skills and personality

4) SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER .

List of reference books:

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

2) Web related references suggested by teacher.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week

Code: CH-MA2-4201(3) SYLLABUS Max. Marks: 100

GENERAL AND PHYSICAL CHEMISTRY

Credits: 03

Course Objective: The objective of the course is to enable students to develop an in-depth knowledge on stereochemistry, bioinorganic chemistry and chemical kinetics

Course Outcomes: By the end of the course, the student will be able to

1. Correlate the properties of organic compounds to the stereochemical features
2. Identify the biological significance of various elements present in the human body.
3. Apply the concepts of ionic equilibrium for the qualitative and quantitative analysis.
4. Determine the order of a chemical reaction and
5. Deduce the Michaelis-Menten equation of enzyme catalysis.

II. 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.

III. 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

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER **B.Sc HONOURS CHEMISTRY: MAJOR** **Time: 2Hrs/Week**

Code **SYLLABUS** **Max. Marks: 50**

Physical Chemistry - Volumetric Analysis

Course Objective: The objective of the course is to train students in the skill of titrimetric analysis

Course outcomes: By the end of the course, the student will be able to

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

Prepare standard solutions, standardize intermediate solutions and estimate the concentrations of unknown solutions through neutralization and redox titrations

Determine the water of crystallization through the titrimetric method.

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 KMnO4 with oxalic acid as primary standard. (internal indicator method)
4. Determination of Fe (II) using KmnO4 with oxalic acid as primary standard. (external indicator method)
5. Estimation of water of crystallization in Mohr's salt by titrating with KmnO4

Co-curricular activities and assessment methods :

Continuous Evaluation: Monitoring the progress of student's learning

Class Tests, Worksheets and Quizzes

Presentations, Projects and Assignments and Group

Discussions: Enhances critical thinking skills and personality

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week

Code: CH-Ma3-4201 SYLLABUS Max. Marks: 100

Nitrogen Containing Organic Compounds & Spectroscopy

Credits: 03

Course Objective: The objective of the course is to enable students to develop deep insights on the preparation and properties of Nitrogen containing organic compounds and applications of spectroscopy

Course Outcomes: By the end of the SEMESTER the student will be able to:

1. Distinguish primary, secondary and tertiary amines based on their properties and reactivity
2. Explain the preparation and properties of amino acids.
3. Classify the nitro hydrocarbons and correlate their reactivity to the keto and aci forms
4. Discuss the aromaticity, preparation and properties of heterocyclic compounds with N O and S.
5. Apply the UV and IR spectral data to ascertain the nature of bonding and functional group in an organic compounds.

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 of diazonium 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

✦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).

II. List of Reference Books

1) A Text Book of Organic Chemistry by Bahl and Arunbahl
2) A Text Book of Organic chemistry by I L FinarVol I
3) Organic chemistry by Bruice
4) Organic chemistry by Clayden

5) Spectroscopy by William Kemp

6) Spectroscopy by Pavia

7) Organic Spectroscopy by J. R. Dyer

8) Elementary organic spectroscopy by Y.R. Sharma

9) Spectroscopy by P.S.Kalsi

10) Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER B.Sc HONOURS CHEMISTRY: MAJOR Time: 2Hrs/Week

Code CH-ma3-4251(2) SYLLABUS Max. Marks: 50

Organic preparations and IR Spectral Analysis

Credits: 02

Organic preparations and IR Spectral Analysis

Course Objective: To train students in varied techniques of organic synthesis and equip them with the skill of synthesizing organic compounds with focus on purity, yield and energy efficiency.

To train students in IR spectral analysis involving identification of functional groups in organic compounds

Course Outcomes: On completion of the course, the student will be able to

1. Engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
2. Dispose off chemicals in a safe and responsible manner
3. Perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
4. Create and carry out work up and separation procedures.

Syllabus:

A. Organic preparations: 40M

1) Acetylation of one of the following compounds: amines (aniline, o-, m-, ptoluidines and 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

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

Co-curricular activities and assessment methods:

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER .

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.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER

20-21 admitted batch-"20AH"

Time: 3Hrs/Week

Course Code: CH-E3-5203

Credits: 3 **Max.Marks:100**

Industrial Chemistry-1

(Skill Enhancement Course (Elective)

COURSE OBJECTIVES:

✔ To introduce concepts related to Chemical industries like cement, fertiliser and paper.

Learning Outcomes:

Students after successful completion of the course will be able to:

- **CO1:** Examine how technological advancements enhances fertilizer quality, yield, and environmental sustainability.
- **CO2:** Assess the economic, environmental, and technological impacts of ceramics and cement
- **CO3:** Compare various surface coatings for durability, corrosion resistance, weathering and chemical exposure.
- **CO4:** Explain the manufacturing process of sucrose from plant .
- **CO5:**Enlist the steps involved in the manufacture of pulp and paper from plant resources.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Fertilizers 10 hours

A brief introduction to industrial chemistry

Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Superphosphate, Compound and mixed fertilizers.

Unit-2: Silicates 10hours

1. **Ceramics:** Important clays and Felds par. Ceramics-types, uses and manufacture. High technology ceramics and their applications.
2. **Cements:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

Unit-3: Surface Coatings 12 hours

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, modified oils, Pigments, toners and lake pigments, fillers, thinners, enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Water and Oil paints.

Unit-4: Sugar Chemistry 08hours

Introduction–Manufacture and recovery of cane sugar from molasses, manufacture of sucrose from beat root, testing and estimation of sucrose.

Unit-5: Paper Industry 10hours

Pulp and Paper-Introduction, Manufacture of pulp, sulphate or Kraft pulp, soda pulp, sulphite pulp, rag pulp, beating, refining, filling, sizing and colouring of pulp, manufacture of paper.

References:

1. E.Stocchi: *Industrial Chemistry*, Vol-I, Ellis HorwoodLtd.UK
2. J.A.Kent: Riegel's *Hand book of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, NewDelhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER

20-21 admitted batch-"20AH"

Time: 3Hrs/Week

Course Code: CH-E3-5253

Credits: 2

(30hrs) (Max.50 Marks)

Industrial Chemistry-1- PRACTICAL SYLLABUS

COURSE OBJECTIVES:

- ✔ To provide the skills of quantitative estimations by deploying instrumental and manual techniques

Lab work-Skills Outcomes:

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

- **CO1:** Determine free acidity in ammonium sulphate fertilizer.
- **CO2:** Learn the procedure for the Estimation of Calcium in Calcium ammonium nitrate fertilizer.
- **CO3:** Demonstrate skills on Estimation of phosphoric acid in superphosphate fertilizer.
- **CO4:** Acquire skills in using colorimetry for the estimation of sucrose.

Practical (Laboratory) Syllabus

Determination of free acidity in ammonium sulphate fertilizer.

3. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
4. Estimation of phosphoric acid in superphosphate fertilizer.
5. Estimation of sucrose by colorimetry.

Lab References

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Text book on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.
3. R.Gopalan, D.Venkappayya, S.Nagarajan: Engineering Chemistry, Vikas Publications.
4. B.K.Sharma: Engineering Chemistry, Goel Publishing House, Meerut

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER

20-21 admitted batch-"20AH"

Time: 3Hrs/Week

Course Code: CH E3 5204
Credits:3

Max.Marks:100

Industrial Chemistry-2

COURSE OBJECTIVES:

- ✔ To enlighten the students on ecofriendly waste management techniques and introduce them to the concept of water quality index

COURSE OUTCOMES:

Students after successful completion of the course will be able to:

- CO1: Classify polymers based on different criteria,
- CO2: Explain the preparation mechanism and enlist the applications of organic polymers.
- CO3: Identify the causes effects and control measures of air pollution.
- CO4: Evaluate water quality through established procedures.
- CO5: Determine the ideal methods of industrial waste management.

Syllabus :*(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Organic Polymers-1 10 hours

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and In organic polymers, Thermoplastic and Thermo setting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross-Linked polymers.

Unit-2: Organic Polymers-2 10 hours

Addition polymers and Condensation polymers, mechanism of polymerization- Free radical, ionic and Zeigler-Natta polymerization. Industrial manufacturing and applications of following polymers, Polystyrene, Poly acrylonitrile, Poly methacrylate, Poly methyl-methacrylate.

Unit-3: Air Pollution 8 hours

Sources of air pollution, acid rain, photochemical smog, Greenhouse effect, Formation and depletion of ozone, sources and effects of various gaseous pollutants: NOx, SOx, SPM, CO, hydrocarbons, controlling methods of air pollution.

Unit-4: Analysis of water 10hours

Determination of total hardness of water, Dissolved oxygen, BOD, COD, total dissolved solids, turbidity, alkalinity, determination of chloride using Mohr's method.

Unit-5: Industrial Waste Management 12hours

Waste water treatment - primary, secondary & tertiary treatment. (All treatment methods in detail). Characteristics of solid wastes, methods of solid waste treatment and disposal, microbiology involved in solid waste disposal, methods of solid waste disposal-composting, sanitary landfilling- economic, aesthetic and environmental problems.

References:

1. E.Stocchi: *IndustrialChemistry*,Vol-I,EllisHorwoodLtd.UK
2. J.A.Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* DhanpatRai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.
7. A.K.De, *Environmental Chemistry*: New Age International Pvt, Ltd, New Delhi.
8. C.k.Varshney: *Water Pollution and Management*, Wiley Eastern Limited, Chennai.
9. S.S. Dara and D.D. Mishra: *Textbook of Environmental Chemistry and Pollution Control*, Revised edition, S.C.Hand &Co Ltd.

Engineering Chemistry, S.S.Dara, S.Chand.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER

20-21 admitted batch-"20AH" Industrial Chemistry-

Time: 3Hrs/Week

Course Code: CH E3 5254

Credits: 2

Max.Marks: 50

-PRACTICAL SYLLABUS

Course Objectives:

- ✔ To enable the students to acquire skill the skills of qualitative and quantitative estimations pertaining to water quality

Lab work-Skills Outcomes:

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

- **CO1:** Learn the procedures for the determination of BOD and COD.
- **CO2:** Demonstrate skills in the determination of chloride in the given water sample
- **CO3:** Acquire skills in determining the hardness of water.

Practical (Laboratory) Syllabus:

(**30hrs**) (Max.50 Marks)

Determination of Hardness of water by EDTA titration.

Determination of Chemical Oxygen Demand (COD)

Determination of Biological Oxygen Demand (BOD)

Determination of chloride using Mohr's method.

Determination of pH, turbidity and total solids in water sample.

Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.

Determination of Ph in soil samples using pH metry.

Lab References:

Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

Textbook on Experiments and Calculations in

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
20-21 admitted batch-"20AH"
Analytical Methods in Chemistry-1

Time:3Hrs/Week

Course Code: CH-E3-5203
Credits:3

Max.Marks:100

COURSE OBJECTIVES:

- ✔ Imbibe understanding on safe laboratory procedures and various methods of qualitative and quantitative estimations

I. Learning Outcomes:

Students after successful completion of the course will be able to:

- **CO1:**Understand the various methods involved in Quantitative analysis.
- **CO2:**Acquire a critical knowledge on separation techniques.
- **CO3:** Demonstrate skills related to Chromatographic techniques through hands on experience.
- **CO4:**Able to engage in safe and accurate laboratory practices by handling laboratory glassware, Equipment and chemical reagents appropriately.
- **CO5:**Comprehend the applications of Chromatographic techniques in different fields.

II. **Syllabus:**

(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

Unit-1: Quantitative analysis-1 **8 hours**

1. A brief introduction to analytical methods in chemistry
2. Principles of volumetric analysis, concentration terms- Molarity, Molality, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards.

2. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.

Unit-2: Quantitative analysis-2 **12hours**

1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations-choice of indicators for the saturations.

2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.

Unit-3: Treatment of analytical data **8hours**

Types of errors- Relative and absolute, significant figures and its importance, accuracy -

methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision-methods of expressing precision, standard deviation and confidence interval.

Unit-4: separation techniques **12 hours**

1. Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III).
2. Ion Exchange method: Introduction, action of ion exchange resins, applications.

UNIT-5: Analysis of water **10hours**

Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolved oxygen, COD, determination of chloride using Mohr's method.

III. References

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug,Seventh edition, Wiley.
3. Quantitative analysis by R.A.DayJr. And A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & CoLtd.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
20-21 admitted batch-"20AH"

Time:3Hrs/Week

Course Code: CH-E3-5253
Credits: 2 **Max.Marks:50**

Analytical methods in chemistry-1

COURSE OBJECTIVES:

- ✔ To train students in solvent extraction and chromatographic techniques.

COURSE OUTCOMES: At the end of the course students will be able to

- **CO1:** List out, identify and handle various equipment in Analytical Chemistry lab.
- **CO2:** Learn the procedures of preparation of primary and secondary standard solutions.
- **CO3:** Demonstrate skills in the preparation of Paper, Thin layer and column Chromatography.
- **CO4:** Acquire skills in observing the Chromatogram.
- **CO5:** Perform some separation techniques of Organic compounds

PRACTICALSYLLABUS

Practical (Laboratory)Syllabus:(**30hrs**) (Max.50 Marks)

1. Estimation of Iron(II) using standard Potassium dichromate solution (using DPA indicator)
2. Estimation of total hardness of water using EDTA
3. Determination of chloride ion by Mohr's method
4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
5. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid, (ii) Ammonium chloride- ammonium hydroxide.
6. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
7. Determination of dissociation constant of a weak acid.

Lab References:

8. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

V SEMESTER

20-21 admitted batch-"20AH"

Course: Cosmetics and Pharmaceutical Chemistry

Time:3Hrs/Week

Course Code: CH-E3-5204

Credits: 3

Max.Marks:100

COURSE OBJECTIVES:

✔ Gain insights on composition of popularly used cosmetics and formulation of specific drugs.

COURSE OUTCOMES : At the end of the course the students will be able to

- **CO1:** Explain the principles of formulation and application of Cosmetics & perfumes.
- **CO2:** Acquire a critical knowledge on synthetic techniques of drugs.
- **CO3:** Demonstrate the skills in various aspects of the fermentation technology and apply for production.
- **CO4:** Comprehend the applications offer mentation.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit- I Chemistry of Cosmetics (8hrs)

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours.

Unit- II Chemistry of Perfumes (8hrs)

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geranial, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmine, Civet one, Mascon.

Unit–III:Drugs & Pharmaceuticals–I (10hrs)

Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, ibuprofen)

Unit–IV Drugs & Pharmaceuticals - II (12hrs)

Synthesis of the representative drugs of the following classes: Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glycerol triturate), antilaprosy (Daps one), HIV-AIDS related drugs (AZT-Zidovudine).

Unit – V Fermentation (12hrs)

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Reference Books:

1. A handbook of lndustrial Organic Chemistry by Samuel P Sadtler, JB Lippincott company.
2. Handbook Industrial Chemistry by Mohammad Farhat Ali Khan, First edition
3. Related online methods available.

4. Industrial Chemistry, E. Stocchi: Vol -I, Ellis Horwood Ltd. UK.
5. Engineering Chemistry P.C. Jain, M. Jain:,Dhanpat Rai & Sons, Delhi.
6. Industrial Chemistry, Sharma, B.K. & Gaur, , Goel Publishing House, Meerut(1996)
7. Introduction to Medicinal Chemistry, G.L. Patrick: Oxford University Press, UK.
8. Medicinal and Pharmaceutical Chemistry, Hakishan, V.K. Kapoor:, Vallabh Prakashan, Pitampura, New Delhi.
9. Principles of Medicinal Chemistry, William O. Foye, Thomas L., Lemke, David A. William: B.I. Waverly Pvt. Ltd. New Delhi.
10. Industrial Microbiology, 3rd Edition, JR Casida L.E. (2015New Age International (P) Limited Publishers, New Delhi, India.
11. Industrial Microbiology: An Introduction. 1st Edition, Waites M.J., Morgan N.L., Rockey J.S. and Higton G. (2001) Blackwell Science, London, UK.
12. Microbiology. 5th Edition, Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Tata McGraw-Hill Publishing Company Limited, New Delhi.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
20-21 admitted batch-"20AH"

Course: Cosmetics and Pharmaceutical Chemistry
-Practical syllabus

Time: 3Hrs/Week

Course Code: CH-E3-5254
Credits: 2 **Max.Marks:50**

Course Objectives:

- ✔ Enable students to gain hands on experience in design and development of certain drug formulations and also develop insights on data collection, organisation and report.

COURSE OUTCOMES: By the end of the course students will be able to

- **CO1:** The ability to develop comprehensive product development prorams to meet new product criteria and timing
- **CO2:**acquire skills in the preparation of cosmeceuticals
- **CO3:**Demonstrate proficiency in the experimental techniques for fermentationand microbial product of enzymes
- **CO4:**carryout perfume testing with the knowledge of perfumes
  learn the procedure of synthesis of drugs
- **CO5:**critically develop, apply , report, interpret and reflect on strategies for collecting data in the lab and fields.

II. **Practical (Laboratory) Syllabus** :(**30hrs**) (Max.50Marks)

1. Identification of various equipment in the laboratory
2. Preparation of talcum powder.
3. Preparation of shampoo.
4. Preparation of hair remover.
5. Preparation of face cream.
6. Preparation of nail polish and nail polish remover.
7. Preparation of Aspirin and it's analysis.
8. Preparation of Magnesium bisilicate (Antacid).
9. Fermentation process.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
20-21 admitted batch-"20AH"
Course: Environmental Chemistry

Time:3Hrs/Week

Course Code: CH-E2-5203
Credits:3

Max.Marks:100

COURSE OBJECTIVES:

- ✔ Provide deep insights into concepts of safe and sustainable environment and also introduce methods and measures to promote environmental quality.

COURSE OUTCOMES: At the end of the course, students will be able to

- **CO1:** Understand the environment functions and how it is affected by human activities.
- **CO2:**Acquire chemical knowledge to ensure sustainable use of the world's resources and ecosystems.
- **CO3:**Engage in simple and advanced analytical tools used to measure the different types of pollution.
- **CO4:**Explain the energy crisis and different aspects of sustainability.
- **CO5:** Analyze key ethical challenges concerning biodiversity and understand the moral principles, goals and virtues important for guiding decisions that affect Earth's plant and animal life.

COURSE:

UNIT-I Introduction 10h

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 10h

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 10h

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 10h

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

10h 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.

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
10. Web related references suggested by teacher.

20-21 admitted batch-"20AH"

Course: Environmental Chemistry
-Practical syllabus

Time: 3Hrs/Week

Course Code: CH-E2-5253
Credits: 2 **Max.Marks:50**

COURSE OBJECTIVES:

- ✔ Inculcate skills relevant to water quality determination through qualitative and quantitative estimations.

COURSE OUTCOMES:

- **CO1:** List out, identify and handle various equipment in Chemistry lab.
- **CO2:**Learn the procedures of preparation of standard solutions.
- **CO3:**Demonstrate skills in operating instruments.
- **CO4:**Acquire skills in handling spectrophotometer.
- **CO5:**Analyse water and soil samples**.**

COURSE:

Practical (Laboratory) Syllabus: (**30hrs**) (Max.50Marks).

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
   - Permanent hardness b) Temporary hardness
4. Determination of Chlorides in water samples by Mohr's method.
5. Determination of pH, turbidity and total solids in water sample.
6. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
7. Determination of PH in soil samples using pH metry.

2. List of Reference books:

1. A Text Book of Quantitative Inorganic Analysis (3rd Edition)–A.I.Vogel
2. Water pollution, Lalude, MC Graw Hill
3. Environmental analysis, SM Khopkar (IIT Bombay)
4. Web related references suggested by teacher.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
20-21 admitted batch-"20AH"
Course: GREEN CHEMISTRY AND NANO TECHNOLOGY

Time: 3Hrs/Week

Course Code: CH-E2-5204
Credits: 3

Max.Marks:100

COURSE OBJECTIVES:

- ✔ Facilitate student understanding on importance and criticality of green procedures and products.

COURSE OUTCOMES: By the end of the couse, the students will be able to

- **CO1**:Understand the importance of Green chemistry and Green synthesis.
- **CO2:** Engage in Microwave assisted organic synthesis.
- **CO3**: Demonstrate skills using the alternative green solvents in synthesis.
- **CO4:**Demonstrate and explain enzymatic catalysis.
- **CO5:** Analyse alternative sources of energy and carry out green synthesis.
- **CO6:**Carry out the chemical method of nanomaterial synthesis.

Syllabus: *Total Hours: 90, including Teaching, Lab, Field Training, Unit tests etc.)*

UNIT-I Green Chemistry: Part- I 10 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, Hunds dicker and Wittig reactions).

UNIT- II Green Chemistry: Part- II 10 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 anthroquinones, Leukart reductive amination of ketones) - Advantages and disadvantages of MAOS. Aldolcondensation –Cannizzaro reaction- Diels-Alder reactions-Strecker's synthesis

UNIT-IV Green catalysis and Green synthesis 10 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 10 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.

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).
8. Green Processes for Nanotechnology: From Inorganic to Bioinspired Nanomaterials, Vladimir A. Basiuk, Elena V. Basiuk Springer (2015)
9. Web related references suggested by teacher.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
20-21 admitted batch-"20AH"

Course: GREEN CHEMISTRY AND NANO TECHNOLOGY
-Practical syllabus

Time: 3Hrs/Week

Course Code: CH-E2-5254
Credits: 2 **Max.Marks:50**

COURSE OBJECTIVES:

- ✔ Enable students to apply green chemistry principles in synthesis and and analysis of compounds.

COURSE OUTCOMES: By the end of the course, the students will be able to

- **CO1.** List out, identify and handle various equipment in the laboratory.
- **CO2:** Learn the procedure of green synthesis.
- **CO3:** Demonstrate skills in the preparation of nano materials.
- **CO4:** Aquire skills in microwave assisted oragnic synthesis.
- **CO5:** Perform some applications of Nanomaterials.

COURSE:

Practical (Laboratory) Syllabus: (30 hrs.) (Max.50 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 and characterization 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.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS)
VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 4Hrs/Week
Code CH 7201(3)
Revised Syllabus Under CBCS 2020-21 Marks: 100

Inorganic Chemistry-I: Advanced Studies in Complexes and Group Theory

Course Objectives: To enable students to understand and apply

- ✔ different theories pertaining to bonding and stability of complex compounds along with
- ✔ Group theoretical principles to establish the 3D geometries and point groups of different molecules.

Course Outcomes:

- **CO1:**The student will understand the VSPER theory, symmetric and unsymmetric Hydrogen bonds in inorganic molecules.
- **CO2:** Understanding the Crystal field theory and Jahn Teller Effects.
- **CO3:**The students will be able to understand the basics of molecular orbital theory and energetic of hybridization.
- **CO4:**The students are able to understand the Jobs method, hard and soft acids and bases.
- **CO5:**The students will acquire the knowledge of symmetry

Syllabus

Unit-I: Chemistry of non- transition elements: 12Hours

Inter halogen compounds, Halogen oxides and oxyfluorides, Clathrate compounds, Spectral and Magnetic properties of Lanthanides and Actinides. Analytical applications of Lanthanides and Actinides. Synthesis, properties and structure of B-N, S-N,P-N cyclic compounds. Intercalation compounds.

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

Unit-II: Structure and Bonding: 12Hours

pπ-dπ bonding, Bent's rule, Non-valence cohesive forces, VSEPR theory. Molecular Orbital theory, Symmetry of Molecular orbitals, Molecular orbitals in triatomic (BeH_2) molecules and ions (NO_2^-) and energy level diagrams. Application of MO theory to square planar ($PtCl_4^{2-}$) and octahedral complexes (CoF_6^{3-} ,$Co(NH_3)_6^{3+}$).Walsh diagrams for linear (BeH_2) and bent(H_2O)molecules.

Unit-III: Metal–ligand bonding: 12Hours

Crystal Field Theory of bonding in transition metal complexes-Splitting of d-orbitals in octahedral, tetrahedral, square planar and Trigonal bipyramidal and Square pyramidal fields. Tetragonal distortions - Jahn-Teller effect. Applications and limitations of CFT. Experimental evidences for covalence in complexes. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor andπ –

acceptor ligands on Δo. Experimental evidence for π-bonding in complexes.

Unit-IV: Metal–ligand Equilibriain solutions: 12Hours

Step wise and overall formation constants. Trends in stepwise constants (statistical effectand statistical ratio). Determination of formation constantsby Spectrophotometric method (Job's method) and Ph metric method (Bjerrum's). Stability correlations -Irwing-William's series. Hard and soft acids and bases (HSAB), Acid-base strengths.

Unit- V: Group theory: 12Hours

Basic concepts of Symmetry and Group theory – Symmetry elements, Symmetry operations and point groups – Schoen flies symbols –Classification of molecules into point groups– Axioms of Group theory– Group multiplication tables for C_{2V} andC_{3V} point groups – Similarity Transformation and classes –Representations – reducible and irreducible representations, Mulliken symbols, Orthogonality theorem and its implications, character table and its anatomy.

Text books:

1. Inorganic Chemistry Huheey, Harper and Row.
2. Physical methods in inorganic chemistry, R.S.Drago. Affliated East-West Pvt. Ltd.
3. Concise inorganic chemistry, J.D. Lee, ELBS.
4. Modern Inorganic Chemistry, W.L. Jolly, Mc Graw Hill.
5. Inorganic Chemistry, K.F. Purcelland J.C .Kotz Holt Saunders international.
6. Concepts and methods of inorganic chemistry, B.E. Douglas and D.H.M.C. Daniel, oxford Press.
7. Introductory quantum Mechanics, A.K. Chandra.
8. Quantum Chemistry, R.K. Prasad.

Reference books:

1. In organic Chemistry, Atkins, ELBS**.**
2. Advanced Inorganic Chemistry, Cotton and Wilkinson, Wiley Eastern**.**
3. Text book of Coordination chemistry, K. Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.
4. Group Theory and its Applications to Chemistry, K.V. Raman, Tata Mc Graw– Hill Publishing Company Ltd. New Delhi.
5. Chemical Applications of Group Theory, F.A. Cotton Wiley Eastern Limited New Delhi

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 2Hrs/Week

Code: CH7251(2)

Revised Syllabus Under CBCS 2020-21 **Marks: 50**

Inorganic Chemistry-I: Advanced Studies in Complexes and Group Theory Practical Syllabus

Course Objectives:

- ✔ To train students in the skill of metal complex synthesis and systematic semi microanalysis of six radical inorganic mixtures.

Course Outcomes:

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

- **CO1:** List out, identify and handle various equipment in Chemistry lab.
- **CO2:** Understand the basic concepts of qualitative analysis of inorganic mixture.
- **CO3:**Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis.
- **CO4:**Acquire skills in elimination interfering anion.
- **CO5:** Identification of less familiar cation.

Syllabus:

Synthesis of Inorganic Metal Complexes:

Synthesis of 3d transition metal complexes of tetrahedral, square planar and octahedral geometries

(i) Tetra ammine copper (II) sulphate monohydrate

(ii) Potassium tris(oxalato) ferrate (III) trihydrate

(iii) Tris(thiourea)copper(I) sulphate

Systematic Semimicro Qualitative Analysis of Inorganic six radical mixtures In systematic Semi micro qualitative inorganic analysis, inorganic mixture contains three cations and three anions. The analysis involves identification and conformation ofcations and anions containing one less familiar cation (Tungsten, Molybdenum, Zirconium, Thorium, Titanium, Uranium, Cerium, Vanadium, Lithium, Berkelium etc.,) and one interfering anion.

Anions: CO_3^{2-} , S^{2-} , SO_3^{2-} , Cl^- , Br^- , I^- , NO^{3-} , SO_4^{2-} , CH_3COO^- , $C_2O_4^{2-}$, $C_4H_4O_6^{2-}$, PO_4^{3-} , CrO_4^{2-} , AsO_4^{3-} , F^- , BO_3^{3-}

Cations: Ammonium (NH_4^+) 1 st group: Hg, Ag, Pb, Tl, W, 2 nd group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo 3 rd

group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be 4 th group:
Zn, Mn, Co, Ni 5 th group: Ca, Ba, Sr 6 th group: Mg,
K, Li

Note: A minimum of 4 inorganic mixtures must be analysed in this Semester.

Reference Books:

1. Practical Inorganic Chemistry, G. Marrand B. W. Rockett.
2. Practical Inorganic Chemistry by G.PassH.Sutchiffe, 2nd ednJohnWiley&Sons.
3. Experimental Inorganic/Physical Chemistry, M.A.Malati, Horwood Publishing,Chichester, UK(1999)
4. Vogel's textbook of semi micro qualitative analysis, 5th Edition by G. Svehla.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM
VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 4Hrs/Week
Code : CH7202(3) Revised Syllabus Under CBCS 2020-21 Marks: 100

Spectroscopy of Organic Compounds

Course Objective: To enable students to understand and apply the theoretical principles of different spectroscopic techniques in the determination of molecular structure
Course Outcomes: By the end of the course, the students will be able to:

- Gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques.
- Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.
- Interpret of IR, UV-visible spectra and their applications.
- Interpret of NMR, Mass spectra and their applications.
- Interpret the spectra in identifying the organic compounds.

II. Syllabus

Unit-I **12 hours**

UV Spectroscopy: a) Energy transitions – Simple chromophores – UV absorption of Alkenes – polyenes unsaturated cyclic systems – Carbonyl compounds, α, β-unsaturated carbonyl systems - Woodward Fisher rules – aromatic systems – solvent effects – geometrical isomerism – acidand base effects – typical examples –calculation of λmax values using Woodward - Fisher rules.

b) **ORD:** Theory of optical rotatory dispersion, α-Axial halo ketone 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 **12 hours**

Infrared Spectroscopy (FT-IR): Fundamental modes of vibrations – Stretchingand 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 **12 hours**

1H 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 it's 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).

Unit-IV **12 hours**

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

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.

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

UNIT-V

MASS SPECTROMETRY **12 hours**

Introduction, ion production, type of ionization, EI, CI, FD, and FAB-factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, common functional groups, molecular-ion peak, metastable peak, Mac Lafferty rearrangement. Nitrogen rule, isotope labeling.High resolution mass spectrometry, Examples of mass spectral Fragmentation of organic compounds with respect to their structure determination.

Suggested Text Books:

1. Organic spectroscopy, W. Kemp 5th Ed, ELBS
2. Spectroscopy of organic compounds, RM Silversteen and others, 5th Ed, John Wiley
3. Spectroscopy of organic compounds, P.S. Kalsi, Wiley, 1993.

References:

4. NMR in chemistry-A multi nuclear introduction, William Kemp, McMillan, 1986.
5. Spectroscopic methods in Organic chemistry, DH Williams & I Flemmi.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 2Hrs/Week

Code CH7252 Revised Syllabus Under CBCS 2020-21 Marks:

50 Spectroscopy of Organic Compounds- Practical Syllabus

Course Objective: To train students in the skill of spectral analysis

Course Outcomes:

By the end of the course students will be able to

- Identify the functional groups present in the molecules
- Apply data to in identification of the molecule
- Describe principles involved in Spectroscopic methods
- Predict number of signals, splitting patterns in the proton NMR of a compound
- Develop ability in the combined use of mass spectrometry and spectroscopic techniques for structure elucidation

Practical Syllabus

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

III. References:

1. NMR in chemistry-A multi nuclear introduction, William Kemp, McMillan, 1986.
2. Spectroscopic methods in Organic chemistry, DH Williams & I Flemmi

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 2Hrs/Week

Code CH7252 Revised Syllabus Under CBCS 2020-21 Marks: 50

Spectroscopy of Organic Compounds- Practical Syllabus

Course Objective: To train students in the skill of spectral analysis

Course Outcomes:

By the end of the course students will be able to

- Identify the functional groups present in the molecules
- Apply data to in identification of the molecule
- Describe principles involved in Spectroscopic methods
- Predict number of signals, splitting patterns in the proton NMR of a compound
- Develop ability in the combined use of mass spectrometry and spectroscopic techniques for structure elucidation

Practical Syllabus

a) Problems involving individual spectral methods – UV, IR, PMR and Mass

b) Problems involving combined any two of UV, IR, PMR and Mass

c) Problems involving combined any three of UV, IR, PMR and Mass

d) Problems involving all four UV, IR, PMR and Mass spectral data.

Co-Curricular Activities:

Mandatory: (Lab/field training of students by teacher:(lab:10+field:05)

e) **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of detection of organic compounds using spectroscopic data.

f) **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the synthetic reaction and obtaining spectral data and analyzing the organic compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

g) Max. Marks for Fieldwork/project work Report: 05.

h) Suggested Format for Fieldwork/project work**:** Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

i) Unit tests (IE).

IV. References:

3. NMR in chemistry-A multi nuclear introduction, William Kemp, McMillan, 1986.

4. Spectroscopic methods in Organic chemistry, DH Williams & I Flemmi

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 4Hrs/Week
Code CH 7203(3) Revised Syllabus Under CBCS 2020-21 Marks: 100

Physical Chemistry – I Thermodynamics, Electrochemistry and Chemical Kinetics

Corse Objective: To familiarize students with advanced concepts pertaining to Thermodynamics, Electrochemistry & Chemical Kinetics

Course Outcomes:

- Students can able to understand the classical thermo dynamics, fugacity.
- Students are able to understand the Electrochemical cells, Liquid junction potential.
- Students understand the Butler - Volmer equation and Ilkovic equation
- Understand the complex reactions, chain reactions.
- Students understand the Branching Chain Reactions, Enzyme catalysis and Photochemical equilibrium.

Syllabus:

Unit-I: Thermodynamics: 12 Hours

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

Unit-II:Electrochemistry-1: 12 Hours

Electrochemical cells - Measurement of EMF - Nernst equation –Equilibrium constant from EMF Data - pH and EMF data -Determination of solubility product from EMF measurements. Concentration cells with and without transference – Liquid junction potential and its determination -Activity and activity coefficients - Debye Huckel limiting law and its verification. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation-verification and limitations- Bjerrum treatment of electrolytes.

Unit-III: Electro Chemistry-II: 12 Hours

Referenceelectrode-Standardhydrogenelectrode.Calomelelectrode-Indicator electrodes:

Metal-metal ion electrodes-Inert electrodes-Membrane electrodes - theory of glass membrane potential, potentiometric titrations, Conductometric titrations. Electrode potentials - Double layer at the interface - rate of charge transfer - Decomposition potential - Overpotential - Tafel plots - Derivation of Butler- Volmer equation for one electrontransfer – electro chemical potential.

Unit-IV: Chemical kinetics and Photochemistry: 12 Hours

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-Michelis-Menten kinetics.

Photo chemistry: Quantum yield and its determination, Actinometry, Reactions with low and high quantum yields, Photo sensitization, Exciplexes and Excimers, Kinetics of collisional quenching- Stern-Volmer equation.

Unit-V: Chemical kinetics - II: 12 Hours

Methods of deriving rate laws - complex reactions - Rate expressions for opposing, parallel andconsecutive reactions involving unimolecular steps. Theories of reaction rates-collision theory-Steric factor-Activated complex theory - Thermodynamicaspects–Uni molecular reactions-Lindemann's theory-Lindemann- Hinshelwood theory. Primary and secondary salt effects. Elementary account of linear free energy relationships-HammetTaftequation - Chain reactions - Rate laws of H2-Br2, photochemical reactionof H_2 - Cl_2. Decomposition of acetaldehyde and ethane-Rice-Hertzfeld mechanism.

Textbooks:

1. Physical Chemistry P.W. Atkins, ELBS.
2. Chemical Kinetics-K.J. Laidler, Mc Graw Hill Pub.
3. Text Book of Physical Chemistry. Samuel Glass tone, Mc millan Pub.
4. Physical Chemistry, G.W. Castellan. Narosa Publishing House

Reference books:

5. Thermo dynamic for Chemists. Samuel Glass tone.
6. Electro chemistry, Samuel Glass tone, Affiliated East West
7. Physical Chemistry, W.J.Moore, Prentice Hall
8. Atomic structure and chemical bond. Manaschanda. Tata Mc Graw Hill Company Limited.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 2Hrs/Week

Code CH 7253(2) Revised Syllabus under CBCS 2020-21 Marks: 50

Physical Chemistry Practical – I

Course Objective: To train students in quantitative estimation using conductometry

Course Outcomes:

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

- List out, identify and handle various equipment in Chemistry lab.
- Learn and apply the concepts of electro chemistry in experiments.
- Be familiar with electro analytical methods and techniques which study an analyte by measuring the potential (volts) and / or current (amperes) in an electro chemical cell containing the analyte..
- Learn the procedures of preparation of standard solutions.5. Acquire skills in operation and calibration of instruments.

Syllabus: Total Hours: 30h (2h/week)

1) Conductometric titration of Strong acid versus Strong base
2) Dissociation constant of weak acid (CH3COOH) by conductometric method.
3) Conductometric titration of Weak acid vs Strong base.
4) Determination of cell constant
5) Acid-catalyzed hydrolysis of methyl acetate
6) Determination of partial molar volume of solute –H2O system by apparent molar volume method.

Reference books:

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th& 6 th Ed. (Pearson Education Asia)

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 4Hrs/Week

Code: CH 7204(3) Revised Syllabus Under CBCS 2020-21 Marks: 100 Green Chemistry

Course Objective: To introduce students to the principles of Green synthesis and Green Analysis

Course Outcomes:

By the end of the course Students will be able to:

- **CO1:** Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances·
- **CO2:** Understand stoichiometric calculations and relate them to green chemistry metrics.
- **CO3:**They will learn about atom economy and how it is different from percentage yield.
- **CO4:** Learn to design safer chemical, products and processes that are less toxic, than current alternatives. Hence, they will understand the meaning of inherently safer design for accident prevention and the principle "what you don't have can't harm you"
- **CO5:** Understand benefits of use of catalyst and bio catalyst, use of renewable feed stock which helps in energy efficiency and protection of the environment, renewable energy sources, and importance led reactions in various green solvents.
- **CO6:** Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems. Thus the students are able to realize that chemistry can be used to solve rather than cause environmental problems.
- **CO7:** Green chemistry is a way to boost profits, increase productivity and ensure sustainability with absolute zero waste. Success stories and real-world cases also motivate them to practice green chemistry.

II. Syllabus:

Unit I: Introduction to Green Chemistry 12 hours

What is Green Chemistry? Some important environmental laws, pollution prevention Act of 1990, emergence of green chemistry, Need for Green Chemistry. Goals of Green Chemistry. Limitations / Obstacles in the pursuit of the goals of Green Chemistry.

Unit II: Principles of Green Chemistry and Designing a Chemical synthesis 14 hours

Twelve principles of Green Chemistry and their explanation with examples Special emphasis on the following:

• Prevention of Waste/ by products; maximum incorporation of the materials used in the process into the final products, Environmental impact factor, waste or pollution prevention hierarchy• Green metrics to assess greenness of a reaction, e.g. Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.

• Prevention/ minimization of hazardous/ toxic products reducing toxicity

• Risk = (function) hazard x exposure

• Designing safer chemicals with minimum toxicity yet has the ability to perform the desired functions

• Green solvents: super critical fluids with special reference to carbon dioxide, water as a solvent For organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solventless processes,solvents obtained from renewable resources and how to compare greenness of solvents

• Energy requirements for reactions – alternative sources of energy: use of microwaves, ultra sonic energy and photochemical energy

• Selection of starting materials; should be renewable rather than depleting, Illustrate with few examples such as biodiesel and polymers from renewable resources (such as green plastic)

• Avoidance of unnecessary derivatization – careful use of blocking/protecting groups

• Use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, bio catalysis, a symmetric catalysis and photocatalysis.

Unit III: Examples of Green Synthesis/ Reactions **12 hours**

• Green Synthesis of the following compounds: adipic acid, catechol, disodium imino diacetate (alternative to Strecker synthesis).

• Green Reagents: Non-phosgene Isocyanate Synthesis, Selective Methylation using di methyl carbonate.

• Microwave assisted solvent free synthesis of copper phthalocyanine

• Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid And Decarboxylation reaction

• Ultrasound assisted reactions: sono chemical Simmons-Smith Reaction (Ultrasonic alternativeto Iodine)

Unit IV: **12 hours**

Real world case studies based on the Presidential green chemistry awards of EPA

• Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO2 for precision cleaning and dry cleaning of garments.

• A new generation of environmentally advanced wood preservatives: Getting the chromium and Arsenic out of pressure treated wood.

• An efficient, green synthesis of a compostable and widely applicable plastic (polylactic acid)made from corn.

• Healthier Fats and oils by Green Chemistry: Enzymatic Inter esterification for production of No Trans-Fats and Oils.

• Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting.

• Using a naturally occurring protein to stimulate plant growth, improve crop quality, increase yields, and suppress disease.

Unit V: Future Trends in Green Chemistry **10 hours**

Oxidation reagents and catalysts; Bio mimicry and green chemistry, Biomimetic, Multifunctional Reagents; mechanochemical and solvent free synthesis of inorganic complexes; co crystal controlled solid state synthesis(C2S3); Green chemistry in sustainable development.

III. Suggested Co-Curricular Activities

1) Training of students by related industrial experts.
2) Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3) Visits of abilities, firms, research organizations etc.
4) Invited lectures and presentations on related topics by field/industrial experts.

IV. Suggested Text Books:

1) Anastas, P.T.; Warner, J.C.(1998),**Green Chemistry, Theory and Practice,** Oxford University Press.
2) Cann , M. C. ; Connely, M. E.(2000), **Real-World cases in Green Chemistry,** AmericanChemical Society, Washington.
3) Matlack, A.S.(2001),**Introduction to Green Chemistry,** Marcel Dekker.
4) Alhuwalia,V. K.; Kidwai, M.R.(2005),**New Trends in Green chemistry**, Anamalaya Publishers

V. References:

1. Kirchoff, M.; Ryan, M.A. (2002), **Greener approaches to undergraduate chemistry experiment.** American Chemical Society, Washington DC.
2. Sharma, R.K.; Sidhwani, I.T.; Chaudhari, M.K.(2013), **Green Chemistry Experiments: A monograph,** I.K. International Publishing House Pvt Ltd. New Delhi.
3. Pavia, D.L.; Lamponam, G.H.; Kriz, G.S.W. B.(2006),**Introduction to organic Laboratory Technique-A Micro-scale approach**,4th Edition, Brooks-Cole Laboratory Series for Organic chemistry.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM
VII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 2Hrs/Week
Code CH 7254(2) Revised Syllabus Under CBCS 2020-21 Marks: 50 Green Chemistry- Practical Syllabus

- ✔ **Course Objective:** To train students in the skill of Green Synthesis and Analysis techniques

Course Outcomes:

By the end of the course students will be able to

- **CO1:** Synthesize nanoparticles using green methods
- **CO2:**Prepare biodiesel form waste cooking oil
- **CO3:** Synthesize inorganic complexes using green methods
- **CO4:**Synthesize benzo pinacol in the presence of sunlight

Practical Syllabus

1. Preparation and characterization of nanoparticles of CuO/ ZnO nanoparticles using plant extracts.
2. Preparation of biodiesel from waste cooking oil and characterization (TLC, pH, Solubility, Combustion Test, Density, Viscosity.
3. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.
4. Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).
5. Photoreduction of benzophenone to benzo pinacol in the presence of sunlight.
6. Spot tests for qualitative inorganic analysis for cations and anions, and qualitative organic analysis for preliminary test and functional group analysis.

Co-Curricular Activities:

Mandatory: (Lab/field training of students by teacher :(lab:10+field:05):

1.
   a. **For Teacher**: Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of green methodologies in place of polluting solvents/chemicals

b. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the green synthetic

2. methods adopted in the industry. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.
3. Max. Marks for Fieldwork/project work Report: 05.
4. Suggested Format for Fieldwork/project work**:** *Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.*
5. Unit tests (IE).

IV References:

1. Wealth from Waste: A green method to produce biodiesel from waste cooking oil and generation of useful products from waste further generated. Indu Tucker Sidhwaniet al. University of Delhi, Journal of Undergraduate Research and Innovation, Volume 1, Issue 1, February 2015, ISSN: 2395-2334.
2. Sidhwani, Tucker I.; Chowdhury, S. Greener alternatives to Qualitative Analysis for Cations without H2S and other sulfur containing compounds, J. Chem. Educ. 2008, 85, 1099.
3. Sidhwani, Tucker I.; Chowdhury, S. et al., DU Journal of Undergraduate Research and Innovation,2016, Volume 2, Issue 2, 70-79.
4. Dhingra, S., ;Angrish, C. Qualitative organic analysis: An efficient, safer, and economical approach to preliminary tests and functional group analysis. *Journal of Chemical Education*,2011, *88*(5), 649-651.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER **B.Sc. HONOURS CHEMISTRY** Time: 4Hrs/Week

Code CH 7206(3) **Revised Syllabus Under CBCS 2020-21** Marks: 100

Polymer Chemistry

Course Objective: To enable students to understand the physical and chemical properties and functional importance of polymers along with the kinetics of polymerization reactions.

Course Outcomes:

By the end of this course, students will be able to:

- Know about history of polymeric materials and their classification
- Learn about different mechanisms of polymerization and polymerization techniques
- Evaluate kinetic chain length of polymers based on their mechanism
- Differentiate between polymers and copolymers
- Learn about different methods of finding out average molecular weight of polymers
- Differentiate between glass transition temperature (Tg) and crystalline melting point (Tm)
- Determine Tg and Tm
- Know about solid and solution properties of polymers
- Learn properties and applications of various useful polymers in our daily life.

Syllabus:

Unit-1: History of polymeric materials and functionality and its importance

10 hours

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers. Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.

Unit-II: Kinetics of Polymerization **12 hours**

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

Unit-III: Determination of molecular weight of polymers and crystallinity

12 hours

(*Mn*,*Mw*, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index. Determination ofcrystalline melting point and degree of crystallinity,Morphology of crystalline polymers, Factors affecting crystalline melting point.

Unit-IV : Glass transition temperature (Tg) and Polymer Solution 14 hours

Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg). Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

Unit-V : Properties of Polymers 12 hours

(Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: poly olefins, polystyrene and styrene copolymers, poly (vinyl chloride) and related polymers, poly (vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [poly acetylene, poly aniline, poly(pphenylene sulphide poly pyrrole, poly thiophene)].

Suggested Text Books:

1. R.B. Seymour & C.E. Carraher: *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
2. G. Odian: *Principles of Polymerization*, 4th Ed. Wiley, 2004.
3. F.W. Billmeyer: *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
4. P. Ghosh: Polymer Science & Technology, Tata McGraw-Hill Education, 1991.
5. R.W. Lenz: *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, New York, 1967.

V. References:

1. Allcock, H.R.; ; Lampe, F. W.; Mark, J. E.(2003),Contemporary Polymer Chemistry, Prentice-Hall.
2. Fried, J.R. (2003), **Polymer** Science and Technology, Prentice-Hall

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER **B.Sc. HONOURS CHEMISTRY** **Time: 2Hrs/Week**

Code CH7256(2) **Revised Syllabus Under CBCS 2020-21** **Marks: 50**

Polymer Chemistry -Practical Syllabus

Course Objectives:

- ✔ To train students in different polymerization techniques and also teach them different molecular weight determination methods.

Course Outcomes:

By the end of the course students will be able to

- **CO1:** Determine the molecular weight of a polymer by viscometric studies
- **CO2:** Prepare urea formaldehyde polymer
- **CO3:** Determine the molecular weight by end group analysis

II. Practical Syllabus

Total Hours: 30h (2hrs/week)

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. Determination of molecular weight by viscometry: Poly vinyl proplylidine (PVP) in water
3. Determination of molecular weight by end group analysis
4. Preparation of urea-formaldehyde resin
5. Precipitation polymerization of acrylonitrile
6. Redox polymerization of acrylamide

III. References:

1. Munk, P.; Aminabhavi, T. M. (2002), Introduction to Macromolecular Science, John Wiley &Sons.
2. Sperling, L.H.(2005),Introduction to Physical Polymer Science, John Wiley & Sons

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER **B.Sc. HONOURS CHEMISTRY** **Time: 2Hrs/Week**

Code CH7256 (2) **Revised Syllabus Under CBCS 2020-21** **Marks: 50**

Polymer Chemistry -Practical Syllabus

Course Objectives: To train students in different polymerization techniques and also teach them different molecular weight determination methods.

Course Outcomes:

By the end of the course students will be able to

- **CO1:** Determine the molecular weight of a polymer by viscometric studies
- **CO2:** Prepare urea formaldehyde polymer
- **CO3:**Determine the molecular weight by end group analysis

Practical Syllabus

Total Hours: 30h (2hrs/week)

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method.
2. Determination of molecular weight by viscometry: Poly vinyl proplylidine (PVP) in water.
3. Determination of molecular weight by end group analysis.
4. Preparation of urea-formaldehyde resin.
5. Precipitation polymerization of acrylonitrile.
6. Redox polymerization of acrylamide

.

References:

9. Munk, P.; Aminabhavi, T. M. (2002), Introduction to Macromolecular Science, John Wiley &Sons.
10. Sperling, L.H.(2005),Introduction to Physical Polymer Science, John Wiley & Sons.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.SC HONOURS CHEMISTRY TIME: 4hrs/week

CODE CH8201(3) Revised Syllabus Under CBCS 2020-21 MARKS: 100

INORGANIC CHEMISTRY-II: METAL CLUSTERS, ELECTRONIC SPECTRA OF COMPLEX COMPOUNDS AND BIO-INORGANIC CHEMISTRY

Course Objective: To introduce students to the advanced concepts of coordination chemistry involving spectral and magnetic properties

Course Outcomes:

- CO1: The Students are able to understand the study of age compounds of oxygen, phosphorous and sulphur compounds and also iso poly and heteropoly anions.
- CO2: The student will understand the various metal clusters and metal π complexes.
- CO3: Understanding the reactions of organometallic compounds and its applications.
- CO4: The Students are able to understanding the reaction mechanism in transition metal complexes, anation reactions, and complementary reactions.
- CO5: The Students are able to understand the orgel diagrams and electronic spectra of transition metal complexes.
- CO6: The study of magnetic properties and anamolous magnetic moments of transition complexes.
- CO7: The Students are able to understanding structure and functions of hemoglobin, myoglobin and vitamin B12, photochemical laws.

Syllabus:

Unit-I: Non-metal cages and metal clusters: **12Hours**

Structure and bonding in phosphorous-oxygen, phosphorous-Sulphur cages; structure and bonding inhigher boranes with (special reference to B12icosahedra). Carboranes, metalloboranes, metallo carboranes. Classification- LNCs and HNCs**,** Isoelectronic and Isolobal relationships, electron counting rules: Wade's and Lauher's rules. M-M multiple bonding; preparation, structure and bonding in di -nuclear $[Re2Cl8]^{2-}$ ion, tri nuclear [Re3Cl9], tetra nuclear $W_4(OR)_{16}$, hexa nuclear $[Mo_6Cl_8]^{4+}$ and $[Nb_6Cl_{12}]^{2-}$.

Unit-II: Organo metallic chemistry of transition metals: 12Hours

Classification and electron counting rules, hepticity, synthesis, structure and bonding of Ferrocene, dibenzene chromium, cycloheptatriene and tropylium complexes of transition metals.

Reactions of organometallic compounds- oxidative addition reductive elimination, insertion and elimination. Applications of organometallic compounds -Catalytic hydrogenation, Hydro formylation.

Unit-III: Reaction mechanism of transition metal complexes: 12Hours

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.

Unit-IV: Term symbols and Electronic spectra: 12Hours

Term symbols: Term symbols and their derivation Microstates, Hunds rules to predict ground terms and ground states. List of ground energy and higher energy terms from d1 to d9 configurations;

Electronic spectra of transition metal complexes: Spectroscopic terms. Selection rules, Slator– Condon parameters, Racah parameters, Term separation energies for d n configurations Correlation diagrams and Orgel diagrams. Tanabe-Sugano diagrams for d 1 tod9 configurations. Calculations of Dq, Band β parameters. Charge transfer spectra.

Unit-V: Bio-inorganic chemistry and Magnetic properties of complexes:

12Hours Storage and transport of dioxygen by Hemoglobin and Myoglobin, Chlorophyll, Vitamin B12 and its importance.

Magnetic properties of transition metal complexes: Orbital and spin contribution, spin orbit coupling and magnetic moments. Types of magnetism, factors affecting on Para magnetism, Dia, ferro and Anti magnetism.

List of Reference books:

1. Inorganic Chemistry by Huheey. Harper and Row.
2. Concise in organic chemistry by J.D. Lee, ELBS.
3. Inorganic chemistry, K.F. Purcelland J.C.Kotz, Holt Saunders international
4. Organometallic chemistry by R.C.Mehrotraand A.Singh. New Age International.
5. Advanced Inorganic Chemistry by Cotton and Wilkinson, Wiley Eastern
6. Inorganic reaction mechanism by Basoloand Pearson, Wiley Eastern
7. Bioinorganic Chemistry by K. Hussan Reddy
8. Biological Aspects of inorganic chemistry by A. W. Addiso,
9. W.R.Cullen, D.Dorphinand G.J.James. Weliey Inter science.

10. Photo chemistry of coordination compounds by V. Balzani and V. Carassiti. Academic Press.
11. Text book of Coordination chemistry by K.Soma Sekhara Rao and K.N.K. Vani, Kalyani Publishers.

ST.JOSEPH'S COLLEGE FOR WOMEN(AUTONOMOUS)

VISAKHAPATNAM

VIII SEMESTER B.SC HONOURS CHEMISTRY TIME:4hrs/week
CODE CH8202(3)

REVISED SYLLABUS UNDER CBCS 2020-21 **MARKS: 100**

ORGANIC CHEMISTRY: MODERN ORGANIC SYNTHESIS AND NATURAL PRODUCTS

Course Objective: To introduce students to advanced concepts pertaining to modern organic synthesis and natural products

Course Outcomes:

- **CO1:**Understanding of various types of reaction intermediates and the bonding present in
- **CO2:** Various organic compounds.
- **CO3:** Understand how to protect various functional groups in organic synthesis and can apply the same to novel molecules useful for research also.
- **CO4:** Students understand the mode of addition reactions involving addition by electrophile and nucleophiles over unsaturated bonds between carbons.
- **CO5:** Students understand the mechanisms of studied named reactions and their applications in organic synthesis.
- **CO6:** Learn about the importance of flavones, flavonoids and hormones.

Syllabus

UNIT - I : Reactive intermediates, Reactive Species and Protecting groups-12 hours

Reactive intermediates: Generation, Structure, Stability, Detection and Reactivity of Carbocations, Carbanions, Free radicals, Carbenes, Nitrenes and Arynes.

Reactive Species: Generation and reactivity of Electrophiles, Nucleophiles, Dienophiles, Ylids, Enophiles.

Protecting groups: Protection of carbonyl, Hydroxyl, carboxylic and Amine groups

UNIT-II : Addition Reactions 12 Hours

(A) **Addition to Carbon – Carbon Multiple Bonds:** Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenationof double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

(B) **Addition to Carbon-Hetero Multiple Bonds:** Steric course of addition reactions to C=O and C=N, Knoevenagel, Claisen- Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Tollen's reaction, Prins reaction: Wittig, Grignard, Mannich, and Michael reaction.

UNIT-III Molecular Rearrangements 12 Hours

Types of molecular rearrangements, migratory aptitude;

a) Rearrangements to electron deficient carbon:Wagner-Meerwein, Tiffeneau–Demjanov, Dienone–Phenol, Arndt-Eistert synthesis;

b) Rearrangements to electron deficient nitrogen: Beckmann, Hofmann, Schmidt and Lossen re-arrangements;

c) Rearrangements to electron deficient oxygen: Baeyer-villiger and Dakin re-arrangements; Benzil-Benzilic acid and Favorskii rearrangements.

UNIT–IV: Steroids 12Hours

Occurrence, nomenclature, basic skeleton, Dielshydro carbon and it's stereo chemistry. Isolation, structure determination and synthesis of and roster one, testosterone, oestrone and progesterone.

UNIT–V: Flavonoids and Isoflavonoids: 12 Hours

Occurrence, nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids.

III. Co-Curricular Activities

1. Training of students by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.

3. Visits of abilities, firms, research organizations etc.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.SC HONOURS CHEMISTRY TIME: 2hrs/week

CODE: CH 8252(2)

REVISED SYLLABUS UNDER CBCS 2020-21 MARKS: 50

ORGANIC CHEMISTRY: MODERN ORGANIC SYNTHESIS AND NATURAL PRODUCTS

ORGANIC CHEMISTRY PRACTICALS –II

Course Objective: To train students in different techniques involved in organic synthesis

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

- List out, identify and handle various equipment in Chemistry lab.
- Learn the concepts and procedures of handling chemical reagents appropriately.
- Demonstrate skills to perform reflux, distillation, recrystallisation and vacuum filtration.
- Calculate theoretical yield and percent yield. .
- Dispose chemicals in a safe and responsible manner.

Syllabus:

Preparation, recrystallization, and determination of melting point & yield of the following compounds: (i) Aspirin, (ii) Nerolin,(iii)Chalcone, (iv) p-Nitro acetanilide, (v) 2,4,6- Tri bromoaniline, (vi) m-Dinitrobenzene, (vii) Phthalimide,

(viii) Diels-Alder adduct.

Reference Books:

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnesand M. J. Thomas, 4th& 6 th Ed. (Pearson Education Asia).

2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G.Smith, A.R. Tatchell, 5 Ed.
(Longman Scientific & Technical)

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.Sc. HONOURS CHEMISTRY Time:4hrs/week

Code CH8203(3) Revised Syllabus Under CBCS 2020-21 Marks: 100

Physical Chemistry: Quantum and Molecular Spectroscopy

Course objective:

- ✔ To introduce students to the basic concepts of quantum chemistry and fundamental aspects of molecular spectroscopy and FORTRAN 77

Course outcomes:

- **CO1:** Students learn the basic non-relativistic quantum mechanics.
- **CO2**:Understand the time-dependent and time-independent Schrödinger equation for simple potentials like for instance the harmonic oscillator and hydrogen like atoms, as well as the interaction of an electron with the electromagnetic field.
- **CO3:**Understand the principles and theories of rotational, vibrational and vibrational spectroscopy methods.
- **CO4:** Interpret the molecular spectra and find molecular properties from molecular spectra.

II. Syllabus:

Unit – I Basic Quantum Chemistry-I: 12 Hours

Wave equation-interpretation of wave function-properties of wave function- normalization and orthogonalisation, Operators- linear and non-linear-commutators of operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator- Eigen values AndEigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

UNIT-II

Basic Quantum Chemistry-II: 12 Hours

Wave mechanics of simple systems with constant potential energy, particle in one-dimensionalboxfactors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling- particle in three-dimensional box. Calculations using wave functions of the particle in a box-

Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy- simple harmonic oscillator- solution of wave equation- selection rules.

UNIT-III

Fundamentals of Molecular Spectroscopy-I: 12 Hours

Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules-Rigid rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and itsapplications. Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators-Selection rulesOvertones- Combination bands- Calculation of force constant, anharmonicityconstant and zero point energy. Fermi resonance, simultaneous vibrational-rotational spectra ofdiatomic molecules.

UNIT- IV

Fundamentals of Molecular Spectroscopy-II: 12 Hours

Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra. Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines- Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

UNIT- V

Introduction to computer programming- FORTRAN 77: 12 Hours

Basic structures and functioning of computer with P.C. as an illustrative example- Main memorySecondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressionsArithmetic statements-Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements-subscripted variable and DIMENSION statement. DO statementRules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cell constant-Electrode potential. Flowcharts and computer programs for

a) Program for the calculation of Cell Constant, Specific Conductance and Equivalence.

b) Rate Constant of First order reaction or Beer's law by linear least square method.

c) Hydrogen ion concentration of a strong acid solution/Quadratic equation.

d) Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
e) Standard deviation and Variance of univariant data.

III. Co-Curricular Activities :

1. Training of students by related industrial experts.

2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3. Visits of abilities, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts

IV. List of Reference books:

1. Fundamentals of Molecular spectroscopy: by C.N. Banwell

2. Molecular spectroscopy: by B.K.Sharma

3. Molecular spectroscopy: by Aruldas

4. Introductory quantum mechanics: by A.K. Chandra

1. Quantum chemistry: by R.K. Prasad

2. Principles of computer programming (FORTRAN 77 IBM PC): by V.Rajaraman

3. Basics of computers for chemists: by P.C. Jurs

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 2hrs/week

Code CH 8253(2) Revised Syllabus Under CBCS 2020-21 Marks: 50

Physical Chemistry: Quantum and Molecular Spectroscopy

PHYSICAL CHEMISTRY PRACTICALS –II

Course Objective:

- ✔ To train students in various instrumental methods of quantitative analysis

Course Outcomes:

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

- CO1: List out, identify and handle various equipment in Chemistry lab.
- CO2: Learn and apply the concepts of electro chemistry in experiments.
- CO3: Be familiar with electro analytical methods and techniques which study an analyte by measuring the potential (volts) and / or current (amperes) in an electro chemical cell containing the analyte.
- CO4: Learn the procedures of preparation of standard solutions.
- CO5: Acquire skills in operation and calibration of instruments.

II. Syllabus:

1. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
2. Titration of Strong acid Vs Strong Base – pH – metry.
3. Titration of mixture of (NaHCO3 + Na2CO3) VsHCl – pH- metry.
4. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
5. Titration of Fe+2Vs K2Cr2O7 – potentiometry
6. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
7. Determination of single electrode potential of Cu2+/Cu and estimate the given unknown concentration.

III. Reference books:

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th& 6th Ed. (Pearson Education Asia).

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.Sc. HONOURS CHEMISTRY Time:4hrs/week

Code :CH8204(3) Revised Syllabus Under CBCS 2020-21 Marks: 100

Pharmaceutical and Medicinal Chemistry

Course Objective: To introduce students to the terminology, classification and synthesis of different categories of drugs

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

- Know the Terminology in Pharmaceutical chemistry.
- Classification of Pharmaceutical chemistry
- Learn the procedure for Synthesis and therapeutic activity of the compounds.
- Acquire knowledge on Pharmacodynamics and Anesthetics Drugs
- Acquire knowledge on HIV-AIDS and Drugs.

II. Syllabus:

UNIT-I

Pharmaceutical chemistry Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors - brief treatment), Metabolites and Anti metabolites. Nomenclature: Chemical name, Generic name and trade names with examples.

UNIT-II

Classification: Classification based on structures and therapeutic activity with one example each, Administration of drugs. Absorption of drugs - factors affecting absorption of drugs, routes of administration - local, enema, oral and external, parental routes - advantages and disadvantages.

UNIT-III

Synthesis and therapeutic activity of the compounds: 12hours

a. Chemotheraputic Drugs

l. Sulpha drugs (Sulpha methoxazole) 2.Antibiotics - β-Lactam Antibiotics, MacrolideAntibiotics,
3. Anti malarial Drugs(chloroquine)

b. Psycho therapeutic Drugs:

1.Anti pyrectics (Paracetamol) 2. Hypnotics, 3.Tranquilizers(Diazepam) 4.Levodopa

UNIT-IV

Pharmacodynamics and Anesthetics Drugs: 12hours

1. Antiasthma Drugs (Salbutamol)

2. Antianginals (Glyceryl Trinitrate)

3. Diuretics(Furosemide)

4. Anesthetics - general - ether, chloroform, ethyl chloride, halothane, nitrous oxide, local - esters - cocaine, benzo cocaine.

UNIT-V

HIV-AIDS: 12 hours

Immunity - CD-4cells, CD-8cells, Retro virus, Replication in human body, Investigation available, prevention of AIDS, Drugs available - examples with structures: PIS: Indinavir (crixivan), Nelfinavir (Viracept), AZT- Zidovudine.

List of Text Books:

1. Synthetic Drugs by O.D.Tyagi & M.Yadav3.Medicinal Chemistry by Ashutoshkar
2. Medicinal Chemistry by P.Parimoo
3. Pharmacology& Pharmacotherapeutics R.S Satoshkar & S.D.Bhandenkar
4. Medicinal Chemistry by Dr. B.V.Ramana
5. Synthetic Drugs by O.D.Tyagi & M.Yadav3.Medicinal Chemistry by Ashutoshkar
6. Medicinal Chemistry by P.Parimoo
7. Pharmacology& Pharmacotherapeutics R.S Satoshkar & S.D.Bhandenkar
8. Medicinal Chemistry by Kadametal P-I & P.II
9. European Pharmacopoeia

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 2hrs/week

Code CH 8254(2) Revised Syllabus under CBCS 2020-21 Marks: 50

Pharmaceutical and Medicinal Chemistry

Practical Syllabus

Course Objective:

- ✔ To enable students to synthesize some common drugs and use the Chem draw software for drawing molecular structures

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

- CO1: Learn the procedure for the synthesis of drugs.
- CO2: Synthesis of Drugs Assisted by Microwave Oven
- CO3:Acquire skills in Drawing structure and Reaction using Chemdraw
- CO4: Know the reactions and mechanisms involved in synthesis of Drugs.

II. Practical (Laboratory) Syllabus

1. Synthesis of Sulphanilamide
2. Synthesis of 7- Hydroxy -4- methyl coumarin
3. Synthesis of Chlorobutanol
4. Synthesis of Tolbutamide
5. Assay of Chlorpheniramine Maleate
6. Assay of Benzyl Penicillin 20k. Synthesis of Aspirin Assisted by Microwave Oven
7. Drawing structure and Reaction using Chemdraw

III. Lab References:

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.

2. Foye's Principles of Medicinal Chemistry.

3. Burger's Medicinal Chemistry, Vol I to IV.

4. Introduction to principles of drug design- Smith and Williams.

5. Remington's Pharmaceutical Sciences.

6. Martindale's extra pharmacopoeia.

7. Organic Chemistry by I.L. Finar, Vol. II.

8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.

9. Text book of practical organic chemistry- A.I.Vogel.

IV. Co-Curricular Activities

a) **Mandatory:**(Lab/field training of students by teacher:(lab: 10+field:05):

1. **For Teacher**: Training of students by the teacher in laboratory and field for not less than15 hours on the field techniques/skills of comprehensive product development programs to meet new product criteria and timing. Acquire skills in the preparationof drugs and pharmaceuticals, learn the procedure of synthesis of drugs with good yield.
2. **For Students**: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observes the preparation of Cosmeceuticals and Pharmaceutical. Write their observations and submit a hand written fieldwork/project work report notexceeding10 pages in thegiven format to the teacher.

a. Max marks for Fieldwork/project work Report: 05.

b. Suggested Format for Fieldwork/project work**:** Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

c. Unit tests (IE)

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.Sc. HONOURS CHEMISTRY Time: 4hrs/week

Code CH 8206(3) Revised Syllabus Under CBCS 2020-21 Marks: 100 Corrosion and Its Prevention

Course Objective: To enable students to understand implications of corrosion and realize the significance and utility of various protective coatings

Course Outcomes: At the end of the course the student will be able to-

- create awareness on corrosion and its control process
- identify protective metallic coatings for prevention of corrosion
- focuses on protective coatings of materials.
- It covers about the insulating materials in electric industries and also become aware about Semiconductors.

II. Syllabus:

Unit-I: Corrosion 12 hours

Introduction - Economic aspects of corrosion - Dry or Chemical Corrosion - Wet or electrochemical corrosion - Mechanism of Electrochemical Corrosion. Galvanic Corrosion - Concentration Cell Corrosion - Differential aeration corrosion - Pitting Corrosion - Underground or soil corrosion – Passivity.

Unit-II: Corrosion and Its Control 12 hours

Factors Influencing Corrosion - Microbiological Corrosion Atmospheric corrosion – Corrosion Control - Proper designing - Using pure metal - Using metal alloys.
Chemical conversion – Coating - Phosphating–Chromising - Treatment of metal surfaceshot dipping - Use of inhibitors.

Unit-III: Protective Coatings 12 hours

PROTECTIVE COATINGS-Introduction - Metallic Coatings - Various methods of cleaning articles before electrode position – Electroplate and - Electroplating methods. Pre-treatment of the surface– Metallic Coatings - Hot Dipping -Cementation or Impregnated Coatings - Sprayed Metal Coatings - Cladding – Vapour Deposition

Unit-IV Paints 12 hours

Paints - ingredients and their functions Required Properties of a Paint-Paint Constituents and Their Functions - Manufacture of Paint. Types of Pigments-Characteristics of pigment - Oils - Uses in Paint Emulsion Paints – Special Paints - Paint Remover Varnishes.

Unit-V: Insulators and Semiconductors 12 hours

Electrical Insulating Materials - Dielectric properties - Requirements of an Electrical Insulating Material - Classification of insulating material - Electrical Rigid Insulations. Semiconductors - Introduction - Classification – Degenerate semiconductors – Super conductors.

List of References Books:

1. M.G. Fontana: Corrosion Engineering, McGraw Hill International Book Co. London.
2. L.L. Shreir: Corrosion, Vol I and Vol II, Newness Butterworths, Edward Arnold
3. Ltd, London.
4. J.C. Scully: Fundamental of Corrosion, Pergamon Press Inc. New York, USA.
5. M.G. Fontana: Corrosion Engineering, McGraw Hill International Book Co.
6. London.
7. L.L. Shreir: Corrosion, Vol. I and Vol. II, Newness Butter worths, Edward Arnold
8. Ltd, London.
9. J.C. Scully: Fundamental of Corrosion, Pergamon Press Inc. New York, USA.
10. V.S. Sastry: Corrosion Inhibitors, Principles & Applications, John Wiley &Sons.
11. C.C. Nathan: Corrosion Inhibitors, NACE, Houston, Texas.
12. Corrosion - Causes and Prevention: Speller. F. N.
13. Material Science mini refresher by H.S. Bawa, Tata publisher India.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VIII SEMESTER B.Sc., HONOURS CHEMISTRY Time: 2hrs/week

Code CH 8256(2)

Revised Syllabus Under CBCS 2020-21 Marks: 50

Corrosion and its Prevention - Practical Syllabus:

Course Objective: To enable students to prepare coatings and pigments and determine the effect of certain physical parameters associated with corrosion

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

- **CO1:** CChalk out a plan to decrease the rate of corrosion.
- **CO2**:Preparation of pigment.
- **CO3:** To study about the Rate of corrosion with respect to Aluminium and Iron plates
- **CO4:**To determine the effect of temperature on rate of corrosion.

II. Practical (Laboratory) Syllabus:

1. Electroless metallic coatings on ceramic and plastic material.
2. Preparation of pigment (zinc oxide)
3. To determine the rate of corrosion on different metallic plates (Iron, Aluminium) in various Concentrations of HCl.
4. To determine the effect of temperature on rate of corrosion in acidic medium.
5. To determine the rate of corrosion on a metallic plate in acidic medium.
6. To determine the rate of corrosion on an Aluminium plate in basic medium.

III. References:

1. Analytical Chemistry by Gary D. Christian 6th edition Wiley publication.
2. Senior Practical Physical Chemistry, B.D. Khosla, V.C. Garg, Adarsh Gulati, R Chand andCo.
3. Applied Chemistry Theory and Practice, O.P. Virani, A.K. Nebula. New Age International Publishers, 2nd Edition.
4. S.W. Rajbhoj and T. K. Chondhekar, Systematic Experimental Physical Chemistry, Anjali Publication, Second Edition 2000.
5. Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria & Sons, Second edition,2008
6. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand &Co.: New Delhi (2011).
7. UGC practical manual for experimental analysis.