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

I SEMESTER B.Sc., HONOURS CHEMISTRY: MAJOR Time:3 Hrs/Week
Code:Ch-ma1-1201 (3) SYLLABUS Max. Marks: 100

GENERAL CHEMISTRY

Credits: 3
25-26 admitted batch

I. LEARNING OBJECTIVES

1. To understand the structure of the atom and its relation to periodic properties.
2. To explain different types of chemical bonding-ionic, covalent, metallic, hydrogen bonding.
3. To apply bonding theories to predict molecular structure and bonding nature.
4. To correlate periodic trends with physical and chemical properties of elements.
5. To evaluate practical applications of nuclear chemistry in science and industry

II. COURSE OUTCOMES:

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

1. Describe the electronic configuration of elements and periodic trends.
2. Analyze the formation and properties of ionic and covalent compounds.
3. Apply VSEPR, hybridization, and MOT to predict molecular geometry and bonding.
4. Explain metallic bonding, hydrogen bonding, and intermolecular forces and relate them to physical properties.
5. Explain types of radioactivity, nuclear reactions, and real-life applications.

III. SYLLABUS:

UNIT-1: ATOMIC STRUCTURE AND PERIODIC TABLE (9 h)

Electronic configuration-Aufbau principle, Hund's rule and Pauli's exclusion principle. Periodic law and arrangement of elements in the periodic table, horizontal, vertical, and diagonal relationships in the periodic table. Definition and periodic trends of atomic radii, ionic radii, covalent radii, ionization potential, electron affinity, and electronegativity, Pauling scale, variable valency, inert-pair effect.

UNIT-2: IONIC BOND (9 h)

Properties of ionic compounds, factors favouring the formation of ionic compounds, Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle - enthalpy of formation of ionic compound and stability, Covalent character in ionic compounds - polarization and Fajan's rules, effects of polarization.

UNIT- 3: COVALENT BOND (9 h)

Valence Bond theory: Hybridization of atomic orbitals and geometry of molecules - $BeCl_2$, BF_3, CH_4, PCl_5, and SF_6

VSEPR model: Effect of bonding and nonbonding electrons on the structure of molecules - NH_3, H_2O, SF_4, $ICl_2^-$and XeF_4

Molecular orbital theory: LCAO method, construction of M.O. diagrams for homo nuclear and hetero nuclear diatomic molecules (N_2, O_2, CO and NO)

UNIT- 4: METALLIC AND HYDROGEN BOND (9 h)

Metallic bond: Metallic properties, free electron theory, band theory of metals. Explanation of conductors, semiconductors and insulators.
Hydrogen bonding: Intra and Inter-molecular hydrogen bonding, influence on the physical properties of molecules, Van der waals forces, dipole-dipole interactions.

UNIT-5: NUCLEAR CHEMISTRY (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 in agriculture and medicine.

IV. REFERENCES:

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,
4. James E. Huheey, **Inorganic Chemistry: Principles of Structure and Reactivity**, 4thed., 2017.
5. W.U. Malik, G.D Tuli, R.D Madan, Selected Topics in Inorganic Chemistry, S. Chand Publishing, 1998.
6. H.J. Arnikar, Essentials of Nuclear Chemistry, New Age International Publishers, 2015.

V. PROPOSED ACTIVITIES:

1. Chart on periodic trends like radii, ionization energy, electronegativity across groups/periods.
2. Worksheet solving- MOT diagrams and hybridization problems.
3. Model Building-Build 3D structures using kits/software for CH_4, PCl_5, XeF_4 etc.

VI. CO-CURRICULAR ACTIVITIES AND ASSESSMENT METHODS

1. Continuous Internal Evaluation (CIA): Monitoring the progress of student's learning.
2. Class Tests, Worksheets, Quizzes, Industrial/Field visits, Student seminars, Poster and PPT presentations, Peer learning, Project-based learning, Assignments, Debates, Group Discussions: Enhances critical thinking skills.
3. Semester End Examination (SEE): Critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

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

I SEMESTER B.Sc., HONOURS CHEMISTRY: MAJOR Time:2 Hrs/Week
Code:ch-ma1-1251 (1)

Credits:1 PRACTICAL SYLLABUS Max. Marks: 50

COURSE 1: QUALITATIVE ANALYSIS OF SIMPLE SALT

I. LEARNING OBJECTIVES:

1. To understand the theoretical principles behind classical qualitative analysis of cations and anions.
2. To develop the ability to identify common cations and anions in inorganic salts.
3. To practice laboratory safety and correct handling of reagents.
4. To record and interpret observations accurately in systematic salt analysis.

II. COURSE OUTCOMES:

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

1. Proper use of glassware, equipment and chemicals in the laboratory
2. Apply systematic procedures to identify one cation and one anion in a given inorganic salt.
3. Analyze reactions based on solubility, color changes, and precipitate formation.
4. Interpret results to draw conclusions and confirm the identity of ions.

III. SYLLABUS:

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, ammonium.

IV. REFERENCES

1. G. Svehla, Vogel's Textbook of Qualitative Inorganic Analysis, Pearson Education, 2008.
2. K. Nagaraj, S. Kamalesu, S. Lokhandwala, N.M. Parekh, Textbook of Semi-micro Inorganic Qualitative Analysis, Notion Press, 2023.
3. G. Pass, H. Sutcliff, Practical Inorganic Chemistry. 2nd edition, John-Wiley & Sons, 2020

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

I SEMESTER B.Sc., HONOURS CHEMISTRY: MAJOR Time: 3Hrs/Week
Code:ch-ma2-1201 (3) SYLLABUS Max Marks: 100

COURSE 2: INORGANIC CHEMISTRY

Credits: 2
25-26 admitted batch

I. LEARNING OBJECTIVES:

1. To explain preparation and uses of selected p-block compounds.
2. To understand the structural and chemical properties of selected p-block compounds.
3. To classify and analyze the characteristics of d- and f-block elements.
4. To compare the properties of lanthanides and actinides.
5. To understand the processes involved in the extraction of metals from their ores.

II. COURSE OUTCOMES:

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

1. Explain the structures and preparation of key p-block compounds.
2. Classify d- and f-block elements and discuss their properties and oxidation states.
3. Analyze magnetic, catalytic, and color properties of transition metals.
4. Compare and contrast lanthanides and actinides based on electronic configuration.
5. Explain and differentiate various metallurgical processes used in the extraction of metals.

III. SYLLABUS:

UNIT-1: CHEMISTRY OF p-BLOCK ELEMENTS – I (9 h)

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

Group 14: Preparation, classification and uses of silicones.

Group 15: Preparation and structure of Phosphonitrilic Chloride $P_3N_3Cl_6$.

UNIT-2: 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-3: CHEMISTRY OF d-BLOCK ELEMENTS (9 h)

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

UNIT-4: CHEMISTRY OF f-BLOCK ELEMENTS (9 h)

Chemistry of Lanthanides: Electronic configuration, oxidation states, colour, magnetic properties, lanthanide contraction, consequences of lanthanide contraction.

comparison of lanthanides and actinides.

UNIT-5: GENERAL PRINCIPLES OF METALLURGY (9 h)

Occurrence of metals, minerals and ores, Concentration of ores- levigation, magnetic separation, froth floatation, leaching, Conversion of concentrated ores to oxide- calcination and roasting, reduction of oxide to the metal, Refining of crude metal-distillation, liquation, poling, electrolysis, zone refining and vapour phase refining, Corrosion and its prevention, Alloys.

IV. REFERENCES:

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, P.W. Atkins, Inorganic Chemistry, W. H. Freeman and Co, London,1999.
4. J.E. Huheey, **Inorganic Chemistry: Principles of Structure and Reactivity**, 4thed., 2017.
5. A.K. Das, Fundamentals of Metallurgy. Tata McGraw Hill Education, 2011.

V. CO-CURRICULAR ACTIVITIES AND ASSESSMENT METHODS:

1. Continuous Internal Evaluation (CIA): Monitoring the progress of student's learning.
2. Class Tests, Worksheets, Quizzes, Industrial/Field visits, Student seminars, Poster and PPT presentations, Peer learning, Project based learning, Assignments, Debates, Group Discussions: Enhances critical thinking skills.
3. Semester End Examination (SEE): Critical indicator of student's learning and teaching methods adopted by teachers throughout the semester

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

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

Code: CH-Ma2-1251(1) SYLLABUS Max. Marks: 50

Course Code 4: INORGANIC CHEMISTRY- I

Credits: 01

25-26 admitted batch

I. LEARNING OBJECTIVES:

1. To understand and apply stoichiometry and principles of inorganic salt preparation.
2. To learn techniques such as crystallization, filtration, and drying.
3. To calculate percentage yields.
4. To handle reagents and lab apparatus safely and precisely

II. COURSE OUTCOMES:

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

1. Demonstrate safe use of laboratory equipment and chemical handling.
2. Describe the theoretical background for the preparation of inorganic salts.
3. Perform synthesis of potash alum, ferrous salts, and cuprous chloride following proper procedures.
4. Analyze colour changes, crystal formation, and yields to evaluate reaction completion.

III. SYLLABUS:

1. Preparation of Potash alum.
2. Preparation of Ferrous oxalate
3. Preparation of Ferrous ammonium sulphate.
4. Preparation of Cuprous chloride.
5. Preparation of Chrome alum.

IV. REFERENCES:

1. G. Svehla, Vogel's Textbook of Qualitative Inorganic Analysis, Pearson Education, 2008.
2. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons, 1989.

V. CO-CURRICULAR ACTIVITIES AND ASSESSMENT METHODS:

1. Internal Practical Assessment
2. Lab Record Evaluation

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

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

Code: ch-ma1-2202 SYLLABUS Max. Marks: 100

25-26 admitted batch

COURSE 3: ORGANIC CHEMISTRY-I

Credits: 03

I. LEARNING OBJECTIVES:

1. To understand the structural theory behind reactivity in organic chemistry.
2. To identify and classify hydrocarbons, their reactions, and stability.
3. To explain organic reaction mechanisms and orientation in aromatic substitution.
4. To apply concepts like resonance, inductive effects, hyperconjugation, and aromaticity.
5. To analyze stereochemistry through molecular representations and optical activity.

II. COURSE OUTCOMES:

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

1. Study Inductive effect, Mesomeric effect, Hyperconjugation and its applications.
2. Explain the preparation and chemical properties of alkanes, alkenes, alkynes and benzene.
3. Analyze and apply Huckel's rule to benzenoid and non-benzenoid aromatic compounds.
4. Differentiate between Markownikoff and Anti-markownikoff addition, Ring activating and deactivating groups.
5. Interpret stereochemical representations and identify chiral molecules.

III. SYLLABUS:

UNIT-1: STRUCTURAL THEORY IN ORGANIC CHEMISTRY (9 h)

Functional groups in organic chemistry, Types of bond fission, Electrophiles, Nucleophiles, Reactive intermediates-carbocations, carbanions & free radicals. Inductive effect and its application: (a) Basicity of amines and (b) Acidity of carboxylic acids, Resonance or Mesomeric effect and its application: (a) Acidity of phenol, and (b) Acidity of carboxylic acids. Hyper conjugation and its application to the stability of carbonium ions.

UNIT-2: SATURATED HYDROCARBONS (ALKANES & CYCLOALKANES) (9 h)

Types of organic reactions: Addition, Elimination, Substitution and Rearrangement reactions.
Alkanes: Preparation of alkanes by Corey House synthesis, Substitution reactions of alkanes.
Cycloalkanes: Cycloalkanes and their relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram.

UNIT-3: UNSATURATED HYDROCARBONS (ALKENES & ALKYNES) (9 h)

Alkenes: Preparation of alkenes by dehydration of alcohols, Saytzeff and Hofmann eliminations, Electrophilic Additions of X_2, H_2O, HX to alkene, Markownikoff and Anti-markownikoff addition, Ozonolysis, Diels-Alder reaction, 1,2- and 1,4-addition reactions in conjugated dienes.
Alkynes: Additions of X_2, H_2O, HX to alkynes, acidity and alkylation of terminal alkynes.

UNIT-4: AROMATICITY, BENZENE AND ITS REACTIVITY

Aromaticity: Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non-Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropylium cation). Electrophilic aromatic substitution benzene- Halogenation, Nitration, Friedel-Craft's alkylation and Friedel- Craft's acylation.

Orientation of aromatic substitution: Ortho, para and meta directing groups with examples, Ring activating and deactivating groups with examples.

UNIT- 5: STEREOCHEMISTRY OF CARBON COMPOUNDS (9 h)

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

Optical isomerism: Optical activity, optical rotation and specific rotation. Chiral molecules-Symmetry elements-enantiomers and diastereomers, Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, and Tartaric acid. Relative configuration (D, L-notation), CIP rules, Absolute configuration (R, S-Configuration)

IV. REFERENCES:

1. R.N. Morrison, R.N. Boyd, Organic Chemistry, Pearson Education, 7th edition, 2010.
2. Peter Sykes, Guidebook to Mechanism in Organic Chemistry, 6th edition, 1985.
3. S.P. Singh, O. Prakash, Reaction mechanism in organic chemistry, Laxmi Publications, 2017.
4. P.Y. Bruice, Organic Chemistry, 8th Edition, Pearson, 2017.
5. V.K. Ahluwalia, P. Bhagat, R. Aggarwal, R. Chandra, Intermediate for Organic Synthesis, I.K. International. 2005.
6. T.W.G. Solomons, C.B. Fryhle, S.A. Snyder, Organic Chemistry, 12th Edition, Wiley, 2016.
7. P.S. Kalsi, Stereochemistry, New Age International, 2015.
8. D. Nasipuri, Stereochemistryof organic compounds, New Age International, 2020.

V. PROPOSED ACTIVITIES:

1. Mechanism writing exercises- Electrophilic aromatic substitution, electrophilic additions.
2. Group quiz on directive effects and reactive intermediates.
3. Concept mapping-Properties of alkane, alkene, alkyne, benzene.

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

II SEMESTER **B.Sc HONOURS CHEMISTRY: MAJOR/MINOR** **Time: 2Hrs/Week**
Code:ch-ma1-2252(1) **SYLLABUS** **Max. Marks: 50**

COURSE 3: ORGANIC PREPARATIONS

25-26 admitted batch

Credits: 01

I. LEARNING OBJECTIVES:

1. Understand mechanisms and conditions for common organic synthesis reactions (nitration, bromination, esterification, acetylation).
2. Perform organic synthesis using appropriate techniques such as heating, reflux, crystallization, and filtration.
3. Develop safe laboratory practices and chemical handling procedures.

II. COURSE OUTCOMES:

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

1. Describe the theoretical background and reaction mechanisms of organic preparations.
2. Synthesize organic compounds using standard laboratory procedures.
3. Analyze reaction steps and evaluate the melting point, and yield of synthesized products.
4. Relate synthesis methods to pharmaceutical and industrial applications.

III. SYLLABUS:

1. Preparation of tribromo aniline
2. Preparation of p-nitroacetanilide
3. Preparation of nerolin
4. Preparation of aspirin (Acetylsalicylic acid)
5. Preparation of paracetamol (Acetaminophen)

IV. REFERENCES:

1. B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R.Tatchell, Vogel's Textbook of Practical Organic Chemistry, Pearson, 2012.
2. V.K. Ahluwalia, R. Agarwal, Comprehensive Practical Organic Chemistry, University

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 4: PHYSICAL CHEMISTRY-I

25-26 admitted batch

Credits: 03

I. LEARNING OBJECTIVES:

1. To understand the theoretical principles governing gases, liquids, solids, and colloidal systems.
2. To apply gas laws and interpret the behavior of real and ideal gases.
3. To describe physical properties of matter in various states and relate them to structural features.
4. To interpret phase diagrams and apply Gibbs' phase rule to one- and two-component systems.

II. COURSE OUTCOMES:

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

1. Explain gas laws, ideal and real gases behaviour, and critical phenomena.
2. Describe properties of liquids and classify types and applications of liquid crystals.
3. Derive Bragg's equation and identify types of crystal defects.
4. Apply the phase rule to interpret phase diagrams and systems with eutectic/congruent/incongruent points.
5. Differentiate between types of adsorption and colloidal systems, and evaluate their applications.

III. SYLLABUS:

UNIT-1: GASEOUS STATE (9 h)

Gas laws, Ideal Gas equation, Vander Waal's equation of state, Andrew's isotherms of carbon dioxide, Critical phenomena, Relationship between critical constants and van der Waal's constants, Law of corresponding states, Joule-Thomson effect, Inversion temperature.

UNIT-2: LIQUID STATE (9 h)

Physical properties of liquids: Definition of vapour pressure, boiling point, surface tension and coefficient of viscosity, Effect of temperature and addition of solutes on surface tension and viscosity.
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-3 SOLID STATE

Law of constancy of interfacial angles, The law of rationality of indices-Miller indices, Symmetry in crystals, 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, Defects in crystals: Stoichiometric and Non-stoichiometric defects.

UNIT-4: PHASE RULE (9 h)

The concept of phase, components, degrees of freedom, Gibbs phase rule, Phase diagram of one

component system – water system, Definition and examples for systems having congruent and incongruent melting point, Study of Phase diagrams of Simple eutectic systems (i) Pb-Ag system, desilverisation of lead (ii) NaCl-Water system, freezing mixtures

UNIT-5: SURFACE CHEMISTRY (9 h)

Colloids: 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.

IV. REFERENCES:

1. P.W. Atkins, J.de., Paula, Atkin's Physical Chemistry, 10th Edition, Oxford University Press, 2014.
2. D.W. Ball, Physical Chemistry, 2nd Edition, Cengage Learning, 2017.
3. G.W. Castellan, Physical Chemistry, 4th Edition, Narosa, 2014.
4. K.L. Kapoor, A Textbook of Physical Chemistry, 6th Edition, McGraw-Hill Education, 2015.

V. PROPOSED ACTIVITIES:

1. Model building: Bravais lattices and symmetry in crystals
2. Chart preparation of phase diagrams (Water, Pb-Ag, NaCl-H2O)
3. PPT: Adsorption isotherms or colloidal behavior.
4. List out applications of Liquid crystals in different display devices.
5. Peer Teaching: Phase rule and eutectic systems

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 Time: 2Hrs/Week

Code:ch-ma1-3251(1) 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;

1. Use glassware, equipment and chemicals and follow experimental protocols in the laboratory
2. Determine melting and boiling points of organic compounds
3. Apply theoretical concepts of organic chemistry for identification and derivatization of functional group and
4. 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(3) SYLLABUS Max. Marks: 100

III -SEMESTER

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:

1. Correlate SN_1, SN_2 and SN_i mechanisms to nucleophilic substitution reactions in alkyl halides & alcohols
2. Describe the reactivity of alcohols and phenols
3. Sketch the mechanistic pathways for selected named reactions of carbonyl compounds
4. Identify the synthetic applications of carboxylic acids & their derivatives and
5. 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-ma2-3252 **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

.

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 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 SYLLABUS Max. Marks: 50

PHYSICAL CHEMISTRY -I

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 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.

III SEMESTER

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

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

Code:ch-ma4-3251 SYLLABUS Max. Marks: 50

COURSE CODE 8: QUALITATIVE INORGANIC ANALYSIS

Credits: 01

Qualitative inorganic analysis

(Minimum of Six mixtures should be analyzed)

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.

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 Text books:

1) A Text Book of Quantitative Inorganic Analysis(3rdEdition) –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-MA1-4201 **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-MA1-4252 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-M-4201 **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: CH-MA2-4252 SYLLABUS Max. Marks: 50

Physical Chemistry - Volumetric Analysis

Credits: 02

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

II 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.

IV. 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

V. 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 .

VI. 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-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 SYLLABUS Max. Marks: 50

Organic preparations and IR Spectral Analysis

Credits: 02

Organic preparations and IR Spectral Analysis

Course Objective:

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

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2 Calculate limiting reagent, theoretical yield, and percent yield
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.

Web related references suggested by teacher.

VISAKHAPATNAM
V SEMESTER
23-24 admitted batch-"23AK"
Course: Environmental Chemistry

Time:3Hrs/Week

Course Code: CH-Ma1-5201
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.

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
23-24 admitted batch-"23Ak"

Course: Environmental Chemistry
-Practical syllabus

Time: 2Hrs/Week

Course Code: CH-Ma1-5201(2)
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
23-24 admitted batch-"23AK"
Course: GREEN CHEMISTRY AND NANO TECHNOLOGY

Time: 3Hrs/Week

Course Code: CH-Ma2-5201(3)
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:

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)

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS),
VISAKHAPATNAM
V SEMESTER
23-24 admitted batch-"23AK"

Course: GREEN CHEMISTRY AND NANO TECHNOLOGY
-Practical syllabus

Time: 2hrs/Week

Course Code: CH-Ma2-5251
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
V SEMESTER
23-24 admitted batch-"23AK"

Time: 3Hrs/Week

Course Code: CH-Ma3-5201
Credits: 3 **Max.Marks:100**

Industrial Chemistry-Fertilizers and surface coatings

(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
23-24 admitted batch-"23AK"

Time: 2Hrs/Week

Course Code: CH-E3-5253

Credits: 2

(30hrs) (Max.50 Marks)

Industrial Chemistry-1- Fertilizers and surface coatings
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

23-24 admitted batch-"23AK"

Time: 3Hrs/Week

Course Code: CH-Ma4-5201
Credits:3

Max.Marks:100

Industrial Chemistry-Polymers and water analysis

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 :

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.

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

23-24 admitted batch-"23Ak"

Industrial Chemistry- Polymers and water Analysis

Time: 2Hrs/Week

Course Code: CH-Ma3-5254
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 Engineering Chemistry, S.S.Dara, S.Chand.