GOVERNMENT DEGREE COLLEGE FOR WOMEN (AUTONOMOUS)

BEGUMPET, HYDERABAD-16

Affiliated To Osmania University, Re-Accredited With 'B^{+}' Grade by NAAC

DEPARTMENT OF CHEMISTRY

SYLLABUS (2017-18)

B.Sc., Chemistry,
I&II Year, CBCS
Syllabus

ngana State Council of Higher Education, Govt. of Telangana B.Sc., CBCS Common Core Syllabi for all Universities in Telangana

PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc., Chemistry from 2016-17

FIRST YEAR- SEMESTER I

CODE	COURSE TITLE	COURSE TYPE	HPW	CREDITS
BS 101	Ability Enhancement Compulsory Course AECC-1	ES	2	2
BS 102	English	CC-1A	4	4
BS 103	Second language	CC-2A	4	4
BS 104	Optional I	DSC-1A	4T+3P=7	4+1=5
BS 105	Optional II	DSC-2A	4T+3P=7	4+1=5
BS 106	**Optional III- Chemistry - I**	**DSC-3A**	**4T + 3P = 7**	**4 + 1 = 5**
	Laboratory Course – I (Qualitative Analysis - Semi Micro Analysis of Mixtures)			
	Total Credits		**31**	**25**

FIRST YEAR- SEMSTER II

BS 201	Ability Enhancement Compulsory Course AECC-2	BCS	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I	DSC-1B	4T+3P=7	4+1=5

BS 205	Optional II	DSC-2B	4T+3P=7	4+1=5
BS 206	**Optional III- Chemistry - II**	**DSC-3B**	**4T = 7**	**4 =**
	Laboratory Course - II (Quantitative Analysis – Titrations)		**3P**	**5** **1**
	Total Credits		**31**	**25**
SECOND YEAR- SEMSTER III				
BS 301	Safety Rules in Chemistry Laboratory and Lab Reagents Remedial methods for pollution, drinking water and Soil fertility	**SE C-1** **SE C-2**	**2** **2**	**2** **2**
BS 302	English	CC-1C	3	3
BS 303	Second language	CC-2C	3	3
BS 304	Optional I	DSC-1C	4T+3P=7	4+1=5
BS 305	Optional II	DSC-2C	4T+3P=7	4+1=5
BS 306	**Optional III- Chemistry - III**			
	Laboratory Course - III (Synthesis of Organic compounds)	**DSC-3C**	**4T = 7** **3P**	**4 =** **5** **1**
	Total Credits		3 1	**25**
SECOND YEAR- SEMSTER IV				
BS 401	Materials and their Applications Chemistry of Cosmetics and Food Processing	**SE C-3** **SE C-4**	**2** **2**	**2** **2**
BS 402	English	CC-1D	3	3

BS 403	Second language	CC-2D	3	3
BS 404	Optional I	DSC-1D	4T+3P=7	4+1=5
BS 405	Optional II	DSC-2D	4T+3P=7	4+1=5
BS 406	**Optional III- Chemistry - IV**	**DSC-3D**	**4T = 7**	**4 = 5**
	Laboratory Course - IV (Qualitative Analysis of Organic Compounds)		**3P**	**1**
	Total Credits		31	**25**

- AECC: Ability Enhancement Compulsory Course, SEC: Skill Enhancement Course, DSC: Discipline Specific Course, GE: Generic Elective, ES: Environmental Science , BCS : Basic computer skills.

THIRD YEAR-SEMESTER-V				
CODE	COURSE TITLE	course TYPE	HPW	CREDI I S
BS 501	Chemistry of Cosmetics, Food Processing, Drugs and Pharmaceuticals	GE	4	4
BS 502	English	CC-IE	3	3
BS 503	Second language	CC-2E	3	3
BS 504	Optional- I A/B	DSE -IE	-	4+1=5
BS 505	Optional- II A/B	DSE -2E	-	4+1=5
BS 506	Optional- III A/B A. Spectroscopy and Chromatography (or) B. Metallurgy, Dyes and Catalysis	DSE -3E	4T = 7	4 = 5
	Laboratory Course -V Experiments in Physical Chemistry-I		3P	1
	TOTAL			25
THIRD YEAR- SEMESTER VI				

BS **601**	Project in Chemistry/ Advanced Chemistry			4
BS 602	English	cc-lF	**3**	3
BS 603	Second language	CC-2F	3	3
BS 604	Optional- I A/D	DSE-IF	-	4+1=5
BS 605	Optional- II A/B	DSE -2F	-	4+1=5
BS 606	Optional- III A/B **A. Medicinal Chemistry** (or) B. **Agricultural and Fuel** Chemistry	DSE -3F	4T = 7 3P	**4** **= 5**
	Laboratory Course -VI Experiments in Physical Chemistry-II			**1**
	TOTAL			25
	TOTAL Credits			150

Programme Outcomes (PO):

After completion of B.Sc.degree in chemistry, students gained theoretical as well as practical knowledge of handling chemicals. Learn laboratory skills, Hands on experience with various analytical instruments, Gain knowledge on Reagents, synthesis of organic/Inorganic compounds and their applications, interpretation of unknown compounds through spectral data and importance of the elements in the periodic table including their physical and chemical nature and role in daily life. Also they expand the knowledge available opportunities related to chemistry like graduate school, professional school and the chemical industries.

Programme Specific Outcome (PSO):

- The students will understand the existence of matter in the universe as solids, liquids, and gases which are composed of molecules, atoms and subatomic particles.
- Students will learn to estimate inorganic salt mixtures and organic compounds both qualitatively and quantitatively using the classical methods of analysis in practical classes.
- Know the fundamental principles of organic/Inorganic /Physical /General chemistry and predict applications of all chemical reactions.
- construct, design, formulate, organise and synthesize new chemical compounds.
- Present a paper in a scientific manner.

CHEMISTRY
SEMESTER WISE
SYLLABUS

COURSE CODE: CHE101
SEMESTER I
Paper I Chemistry - I

Unit-I (Inorganic Chemistry) 15 h (1 hr/week)

S1- I-1. Chemical Bonding 8 h

Ionic solids- lattice and solvation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions. VSPER Theory - Common hybridization- sp, sp^2, sp^3, sp^3d, sp^3d^2 and sp^3d^3, shapes of molecules. Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of bonds. Criteria for orbital overlap. LCAO concept. Pi and Sigma overlapping. Concept of Types of molecular orbitals- bonding, anti-bonding and non-bonding. MOED of Homo nuclear diatomics - H2, N2, $O2^{-}$, $O2^{2-}$, F2 (unhybridized diagrams only) and hetero nuclear diatomics CO, CN^{-}, NO, NO^{+} and HF. Bond order, stability and magnetic properties.

S1-I-2. P-Block Elements 1 7 h

Group–13: Structure of Diborane and higher Boranes (B4H10 and B5H9), Boron nitrogen compounds (B3N3H6 and BN) Lewis acid nature of BX3. Group – 14: Carbides-Classification – ionic, covalent, interstitial – Structures and reactivity. Industrial applications. Silicones – Classification – straight chain, cyclic and cross-linked. Group – 15: Nitrides – Classification – ionic, covalent and interstitial. Reactivity – hydrolysis. Reactions of hydrazine, hydroxylamine, phosphazenes.

Unit - II (Organic Chemistry) 15h (1 hr/week)

S1-O-1: Structural Theory in Organic Chemistry 5 h

Bond polarization: Factors influencing the polarization of covalent bonds, electro negativity – inductive effect. Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids and basicity of anilines. Stability of carbocations, carbanions and free radicals. Hyper conjugation and its application to stability of carbonium ions, free radicals and alkenes.

S1-O-2: Acyclic Hydrocarbons **6 h**

Alkanes– Methods of preparation: From Grignard reagent, Kolbe synthesis. Chemical reactivity

- Inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

Alkenes - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1, 2 dihalides, Zaitsev's rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H2O, HOX, H2SO4 with mechanism and addition of HBr in the presence of peroxide (Anti – Markonikov's addition). Oxidation (cis –

additions) – hydroxylation by KMnO4, OsO4, Anti addition- per acids (via epoxidation) hydroboration, ozonolysis – location of double bond. Dienes – Types of dienes, reactions of conjugated dienes – 1, 2 and 1,4 addition of HBr to 1,3 – butadiene and Diels – Alder reaction.

Alkynes– Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Chemical reactivity – electrophilic addition of X2, HX, H2O (tautomerism), Oxidation (formation of enediol, 1, 2 diones and carboxylic acids) and reduction (Metal-ammonia reduction, catalytic hydrogenation).

Aromatic Hydrocarbons **4h**

Introduction to aromaticity: Huckel's rule – Benzene, Naphthalene and Anthracene. Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation and halogenation, Friedel Craft's alkylation and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. Orientation – (i) activating groups: Amino, methoxy and alkyl groups. (ii) Deactivating groups - nitro, nitrile, carbonyl, carboxylic acid, sulphonic acid and halo groups.

Unit – III (Physical Chemistry) **15h (1 hr/week)**

S1-P-1: Atomic structure and elementary quantum mechanics **3 h**

Black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck's radiation law, photoelectric effect, Limitations of classical mechanics, Compton Effect, de Broglie's hypothesis. Heisenberg's uncertainty principle.

S1-P-2: Gaseous State **5 h**

Deviation of real gases from ideal behavior. van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO2. The van der Waal's equation and critical state. Derivation of relationship between critical

constants and van der Waal's constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquifaction of gases: i) Linde's method based on Joule Thomson effect ii) Claude's method based on adiabatic expansion of a gas.

S1-P-3: Liquid State and Solutions 4 h

Liquid State

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Surface tension and its determination using a stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Solutions 3 h

Liquid - liquid mixtures, ideal liquid mixtures**,** Raoult's and Henry's laws. Non ideal systems,Azeotropes: HCl-H_2O and C_2H_5OH - H_2O systems. Fractional distillation, Partially miscible liquids: Phenol – Water, Trimethylamine – Water and Nicotine – Water systems.

Unit - IV (General Chemistry) 15h (1 hr/week)

S1-G-1. General Principles of Inorganic Qualitative Analysis 6 h

Anion analysis: Theory of sodium carbonate extract,classification and reactions of anions- CO_3^{2-},Cl^-, Br^-, 4^{2-}, $PO4^{3-}$, BO_3^{3-}, CH_3COO^-, $NO3^-$. Interfering ions. Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations (Hg^{2+}, Ag^+, Pb^{2+}) with flow chart and chemical equations. Principle involved in separation of group II & IV cations. General discussion for the separation and identification of group II (Hg^{2+}, Pb^{2+}, Bi^{3+}, Cd^{2+}, Sb^{3+}), III (Al^{3+}, Fe^{3+}), IV (Mn^{2+}, Zn^{2+}) individual cations with flow chart and chemical equations. General discussion for the separation and identification of group V individual cations (Ba^{2+}, Sr^{2+}, Ca^{2+}) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg^{2+}, NH_4^+).

S1-G-2. Isomerism 5 h

Isomerism: Definition of isomers. Classification of isomers: Constitutional and Stereoisomers - definition and examples. Constitutional isomers: chain, functional and positional isomers. Stereoisomers: enantiomers and diastereomers – definitions and examples. Representation of stereoisomers – Wedge, Fischer projection, Sawhorse, Newmann formulae.

Conformational analysis: Classification of stereoisomers based on energy. Definition and examples Conformational and configurational isomers. Conformational analysis of ethane, n-

butane, 1, 2- dichloroethane,2-chloroethanol .Cyclic compounds: Baeyer's strain theory, Conformational analysis of cyclohexane, Cis-trans isomerism: E-Z-Nomenclature

S1-G-3: Solid state Chemistry **4 h**

Laws of Crystallography: (i) Law of Constancy of interfacial angles (ii) Law of Symmetry-Symmetry elements in crystals (iii) Law of rationality of indices. Definition of space lattice, unit cell. Bravais Lattices and Seven Crystal systems (a brief review). X-ray diffraction by crystals; Derivation of Bragg's equation. Determination of structure of NaCl, KCl and CsCl (Bragg's method and Powder method).

Unit-I (InorganicChemistry)

1. To predict the atomic structure, chemical bonding, and molecular geometry based on accepted models.
2. Characterize bonding between atoms, molecules, interaction and energetics (ii) hybridization and shapes of atomic, molecular orbitals, bond parameters, bond- distances and energies.
3. Valence bond theory incorporating concepts of hybridization predicting geometry of molecules.
4. Importance of hydrogen bonding, metallic bonding.
5. Predicting structure of molecules
6. Structure, bonding of p block materials and their oxides/compounds.
7. Understanding chemistry of compounds of p block elements and their structures.

UNIT II Organic Chemistry

1. Basic of organic molecules, structure, bonding, reactivity and reaction mechanisms.
2. Aromatic compounds and aromaticity, mechanism of aromatic reactions.
3. Understanding hybridization and geometry of atoms, 3-D structure of organic molecules.
4. Reactivity, stability of organic molecules, structure, stereochemistry.
5. Electrophile, nucleophiles, free radicals, electronegativity, resonance, and intermediates along the reaction pathways.
6. Mechanism of organic reactions (effect of nucleophile/leaving group, solvent), substitution vs. elimination.

Unit-III Physical Chemistry

Atomic theory and its evolution.

Learning scientific theory of atoms, concept of wave function.

1. Familiarization with various states of matter.
2. Physical properties of each state of matter and laws related to describe the states.

3. Understanding Kinetic model of gas and its properties.
4. Behavior of real gases, its deviation from ideal behavior, equation of state, isotherm, and law of corresponding states.
5. Liquid state and its physical properties related to temperature and pressure variation.
6. Properties of liquid as solvent for various household and commercial use.

Unit-IV General Chemistry.

Stereochemistry of organic molecules – conformation and configuration, asymmetric molecules and nomenclature.

3-D structure of organic molecules, identifying chiral centers.

Solids, lattice parameters – its calculation, application of symmetry, solid characteristics of simple salts.

Laboratory Course

I Practical (Inorganic Chemistry)

Paper I - Qualitative Analysis - Semi micro analysis of mixtures **45h (3 h / week)**

Analysis of two anions (one simple, one interfering) and two cations in the given mixture.

Anions: $CO3^{2-}$, $SO3^{2-}$, S^{2-}, Cl^{-}, Br^{-}, I^{-}, CH_3COO^{-}, $NO3^{-}$, $PO4^{3-}$, $BO3^{3-}$, $SO4^{2-}$. .

Cations: Hg^{2+}, Ag^{+}, Pb^{2+}

$_{Hg}2+_{,\,Pb}2+_{,\,Bi}3+_{,\,Cd}2+_{,\,Cu}2+_{,\,As}3+/5+_{,\,Sb}3+/5+_{,\,Sn}2+/4+$

Al^{3+}, Cr^{3+}, Fe^{3+}

Zn^{2+}, Ni^{2+}, Co^{2+}, Mn^{2+}

Ba^{2+}, Sr^{2+}, Ca^{2+}

Mg^{2+}, NH^{+}

II. Inorganic quantitative Analysis-Inorganic Preparations

1. Tetraamine Copper (II) Sulphate
2. Potash alum KAl (SO4)2. 12H2O,

The objective of B.Sc. Chemistry Practical – I is intended to provide:

- Qualitative semimicro analysis of mixtures containing 2 anions and 2 cations.
- Emphasis should be given on understanding of the chemistry of different reactions.
- To get acquainted with basic preparation methods of inorganic metal complexes.

OUTCOMES.

After the successful completion of the course, students should be able to:

- To get adapted with techniques involved in Qualitative semimicro analysis.
- To get acknowledged with various chemical reactions of basic and acidic radicals.
- To get acknowledged withtechniques involved inpreparation methods of inorganic metal complexes.

B.Sc I Yr CHEMISTRY SEMESTER WISE SYLLABUS

SEMESTER II COURSE CODE: CHE201

Unit-I (Inorganic Chemistry) 15 h (1 hr/week)

S2-I-1 P-block Elements -II 7 h

Oxides: Types of oxides (a) Normal- acidic, basic amphoteric and neutral (b) Mixed
b. sub oxide d) peroxide e) superoxide. Structure of oxides of C, N, P, S and Cl - reactivity, thermal stability, hydrolysis.

Oxy acids: Structure and acidic nature of oxyacids of B, C, N, P, S, Cl and I. Redox properties of oxyacids of Nitrogen: HNO_2 (reaction with $FeSO_4$, $KMnO_4$, $K_2Cr_2O_7$), HNO_3 (reaction with H_2S, Cu), HNO_4 (reaction with KBr, Aniline), $H_2N_2O_2$ (reaction with $KMnO_4$). Redox properties of oxyacids of Phosphorus: H_3PO_2 (reaction with $HgCl_2$), H_3PO_3 (reaction with $AgNO_3$, $CuSO_4$) . Redox properties of oxyacids of Sulphur: H_2SO_3 (reaction with $KMnO_4$, $K_2Cr_2O_7$), H_2SO_4 (reaction with Zn, Fe, Cu), $H_2S_2O_3$ (reaction with Cu, Au), H_2SO_5 (reaction with KI, $FeSO_4$), $H_2S_2O_8$ (reaction with $FeSO_4$, KI). Redox properties of oxy acids of Chlorine.

Interhalogens- Classification- general preparation- structures of AB, AB_3, AB_5 and AB_7 type and reactivity.

Pseudohalogens: Comparison with halogens.

S2-I-2: Chemistry of Zero group elements 2 h

Isolation of noble gases, Structure, bonding and reactivity of Xenon compounds – Oxides, Halides and Oxy-halides. Clatherate compounds and Anomalous behaviour of He (II)

S2-I-3: Chemistry of d-block elements 6 h

Characteristics of d-block elements with special reference to electronic configuration, variable valence, ability to form complexes, magnetic properties &catalytic properties. Stability of various oxidation states and standard reduction potentials. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu triads. Titanium triad – electronic configuration and reactivity of +3 and +4 states – oxides and halides. Chromium triad
– reactivity of +3 and +6 states. Copper triad – reactivity of +1, +2 and +3 states.

Unit - II (Organic Chemistry) 15h(1 hr/week)

S2-O-1: Halogen compounds 4 h

Classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reactions – classification into SN1 and SN2. Mechanism and energy profile diagrams of SN1 and SN2 reactions. Stereochemistry of SN2 (Walden Inversion) 2-bromobutane, SN1 (Racemisation) 1- bromo-1-phenylpropane Structure and reactivity – Ease of hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.

S2-O-2: Hydroxy compounds and ethers 6 h

Alcohols: Preaparation: 1°, 2° and 3° alcohols using Griganard reagent, Reduction of Carbonyl compounds, carboxylic acids and esters. Physical properties: H-bonding, Boiling point and Solubility. Reactions with Sodium, HX/ZnCl2 (Lucas reagent), esterification, oxidation with PCC, alk. KMnO4, acidic dichromates, conc. HNO3 and Oppenauer oxidation (Mechanism).

Phenols: Preparation: (i) from diazonium salts of anilines, (ii) from benzene sulphonic acids and (iii) Cumene hydroperoxide .Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution; halogenations, Riemer Tiemann reaction (Mechanism), Kolbe reaction (Mechanism), Gattermann-Koch reaction, Azo-coupling reaction, Schotton-Boumann raction, Houben-Hoesch condensation, .

Ethers: Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of conc. H2SO4. Physical properties – Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties – inert nature, action of conc. H2SO4 and HI.

S2-O-3 Carbonyl compounds 5 h

Preparation of aldehydes & ketones from acid chloride,1,3-dithianes, nitriles and from carboxylic acids. Special methods of preparing aromatic aldehydes and ketones by (a) Oxidation of arenes (b) Hydrolysis of benzyl halides Physical properties – absence of Hydrogen bonding. Reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of (a) NaHSO3 (b) HCN (c) RMgX (d) NH3 (e) RNH2 (f) NH2OH (g) PhNHNH2 (h) 2,4-DNP (Schiff bases). Addition of H2O to form hydrate , chloral hydrate (stable), addition of alcohols - hemiacetal and acetal formation. Cannizaro reaction. Oxidation reactions – KMnO4 oxidation and autoxidation, reduction – catalytic hydrogenation, mechanism of Clemmenson's reduction, Wolf- kishner reduction, Meerwein Pondoff Verly reduction. Reduction with LAH, NaBH4.

Unit - III (Physical Chemistry) 15h(1 hr/week)

S2-P-1: Electrochemistry 15 h

Electrical transport – conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific and equivalent conductance with dilution. Migration of ions and Kholrausch's law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law - its uses and limitations. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf's method for attackable electrodes. Applications of conductivity measurements: Determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Electrolytic and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. Electro motive force (EMF) of a cell and its

measurement. Computation of EMF. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble

salt and redox electrodes. Electrode reactions, Nernst equation, cell EMF and Single electrode potential, Standard Hydrogen electrode – reference electrodes (calomel electrode)
– standard electrode potential, sign conventions, electrochemical series and its significance. Applications of EMF measurements. Calculation of thermodynamic quantities of cell reactions (Gibbs free energy G, Helmholtz free energy and Equilibrium constant K). Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode. Solubility product of AgCl. Potentiometric titrations.

Unit – IV (General Chemistry) 15 h (1 hr/week)

S2-G-1: Theory of Quantitative Analysis 6 h

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i) neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid –weak base, weak acid- strong base and weak acid –weak base. Theory of redox titrations - internal(KMnO4) and external indicators – use of diphenylamine and ferroin indicators. Theory of complexometric titrations – use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations – theory of adsorption indicators.

Gravimetric analysis- Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drying and incineration of precipitate, coprecipitation and post precipitation. Determination of Ni^{2+}

S2-G-2: Stereoisomerism 5 h

Optical activity: Definition, wave nature of light, plane polarised light, optical rotation and specific rotation, chiral centers. Chiral molecules: definition and criteria - absence of plane,

center and Sn axis of symmetry – asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and disymmetric molecules (trans- 1,2-dichlorocyclopropane). Molecules with constitutionally symmetrical chiral carbons (Tartaric acid) Molecules with constitutionally unsymmetrical chiral carbons (2,3dibromopentane). D, L configuration – examples. R, S – configuration: Cahn-Ingold-Prelog rules, examples for asymmetric and disymmetric molecules.

S2-G-3: Dilute Solutions & Colligative Properties 4 h

Dilute Solutions, Colligative Properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis - laws of osmotic pressure, its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point. Derivation of relation between molecular weight and elevation in boiling point and depression in freezing point.

OBJECTIVES OF SEMESTER-II

The objective of **B.Sc. Chemistry II** is intended to provide:

- Structure, bonding of p block materials and their oxides/compounds.
- Understanding chemistry of compounds of p block elements and their structures.
- Transition metals, its stability, color, oxidation states and complexes.
- Familiarization about classes of organic compounds and their methods of preparation and Basic uses of reaction mechanisms.
- Name reactions, uses of various reagents and the mechanism of their action.
- Basic principle of laws of electrochemistry and understanding about chemical cells, electrodes and their functions.
- Stereochemistry of organic molecules – conformation and configuration, asymmetric molecules and nomenclature.
- Partial molar quantities and its attributes.
- Dilute solution and its properties.

OUTCOMES

After the successful completion of the course, students should be able to:

- To get acquainted with application of VSEPR theory in explaining structure and bonding.
- To interpret nature of compounds of p block elements.
- To understand about the inert nature of Zero group elements, factors responsible for their reactivity and explaining structure and bonding.
- To get acquainted with characteristics of d block elements.
- To understand about the preparations, physical & chemical properties of classes of organic compounds.
- To know the basic principles of electrochemistry and its applications in daily life.
- To understand the nature of dilute solutions and its properties.

Laboratory Course 45hrs (3 h / week)

Paper II- Quantitative Analysis

Analysis Acid - Base titrations

1. Estimation of Carbonate in Washing Soda.
2. Estimation of Bicarbonate in Baking Soda.
3. Estimation of Carbonate and Bicarbonate in the Mixture.
4. Estimation of Alkali content in Antacid using HCl.
5. Estimation of NH^+ by back titration

Redox Titrations

1. Determination of Fe(II) using K2Cr2O7
2. Determination of Fe(II) using KMnO4 with sodium oxalate as primary standard.

Complexometric Titrations

1. Estimation of Mg^{2+}

Inorganic preparatios

1. Bis (dimethylglyoximato) Nickel(II)
2. Hexammine cobalt(III) Chloride

Objectives of practicals

- The objective of B.Sc. Chemistry Practical - II is intended to provide:
- To get acknowledged with techniques involved in quantitative analysis of products.
- To get acknowledged with techniques involved in Redox titrations and Complexometric titrations.
- To get acknowledged with techniques involved in preparation methods of inorganic metal complexes.

OUTCOMES

- After the successful completion of the course, students should be able to:
- To get adapted with techniques involved in Quantitative analysis of products.
- To get acknowledged with techniques involved in preparation methods of inorganic metal complexes.

B.Sc. II Year CHEMISTRY SEMESTER WISE SYLLABUS SEMESTER III

COURSE CODE: CHE301

Paper-III Chemistry - III

Unit-I (Inorganic Chemistry) 15 h (1 hr/week)

S3-I-1: Chemistry of f-block elements: 5 h

Chemistry of Lanthanides**:** Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behavior of post lanthanides-complexation- type of donor ligands preferred. Magnetic properties- para magnetism. Colour and spectra, f-f transitions –occurrence and separation– ion exchange method, solvent extraction.

Chemistry of actinides- general features – electronic configuration, oxidation state, actinide contraction, colour and complex formation. Comparison with lanthanides.

Additional Inputs: Comparision between f – Block and d-Block elements

S3-I-2: Coordination Compounds-I 6 h

Simple inorganic molecules and coordination complexes. Nomenclature – IUPAC rules,Coordination number, coordination geometries of metal ions, types of ligands. 2. Brief review of Werner's theory,Sidgwick's electronic interpretation and EAN rule and their limitations. (Valence bond theory (VBT) – postulates and application to (a) tetrahedral complexes $[Ni(NH_3)_4]^{2+}$ $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$ **(**b) Square planar complexes $[Ni(CN)_4]^{2-}$, $[Cu(NH3)_4]^{2+}$, $[PtCl_4]^{2-}$ (c) Octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$ $[FeF_6]^{4-}$, $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-.}$ Limitations of VBT. 3. Isomerism in coordination compounds, stereo isomerism – (a)Geometrical isomerism in (i) square planar meta l complexes of the type$[MA_2B_2]$ $[MA_2BC]$ $[M(AB)_2]$ [MABCD] (ii) Octahedral metal complexes of the type $[MA_4B_2]$, $[M(AA)_2B_2]$ $[MA_3B_3]$ using suitable examples, (b) Optical isomerism in (i). Tetrahedral complexes [MABCD] (ii). Octahedral complexes $[M(AA)_2B_2]$, $[M(AA)_3]$ using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

Additional Inputs: Hydration isomerism

S3-I-3: Metal carbonyls and Organometallic Chemistry 4 h

Metal carbonyls: Preparation and properties of Ni(CO)4. Structural features of Ni(CO)4, Fe(CO)5, Fe2(CO)9, Fe3(CO)12 and Cr(CO)6 -18 valence electron rule.

Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg & Al.

Additional Inputs: Structure of $Fe(CO)_5$

Unit - II (Organic Chemistry) 15h (1 hr/week)

S3-O-1: Carboxylic acids and derivatives 5 h

Preparation: a) Hydrolysis of Nitriles, amides and esters. b) Carbonation of Grignard reagents. Special methods of preparation of Aromatic Acids - Oxidation of Arenes. Physical properties- hydrogen bonding, dimeric association,. Chemical properties – Reactions involving H, OH and COOH groups -salt formation, anhydride formation, Acid halide formation, Esterification (mechanism) & Amide formation. Reduction of acid to the corresponding primary alcohol - via ester or acid chloride. Degradation of carboxylic acids by HunsDiecker reaction, Schmidt reaction (Decarboxylation). Arndt – Eistert synthesis, Halogenation by Hell – Volhard - Zelensky reaction. Carboxylic acid Derivatives – Hydrolysis nand Amonolysis of acid halides, Acid anhydrides and esters (mechanism of ester hydrolysis by base and acid). Hydrolysis and dehydration of amides.

Additional Inputs: Comparision of acidic strength of carboxylic acid and alcohol

S3-O-2: Nitrohydrocarbons 3 h

Preparation of Nitroalkanes. Reactivity - halogenation, reaction with HNO2 (Nitrous acid), Nef reaction, reduction. Aromatic Nitrohydrocarbons: Preparation of Nitrobenzene by Nitration. Physical properties, chemical reactivity –Reduction of Nitrobenzenes in different media.

Additional Inputs: Acidic nature of α-Hydrogen of Nitrohydrocarbons

S3-O-3: Amines, Cyanides and Isocyanides 7 h

Amines: classification into 1°, 2°, 3° Amines and Quarternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1°, 2°, 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3° Amines, diazotization. Diazonium salts: Preparation with mechanism. Synthetic importance – a) Replacement of diazonium group by – OH, X (Cl)-Sandmeyer and Gatterman reaction, by fluorine (Schiemann's reaction), by iodine, CN, NO2, H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

Cyanides and isocyanides: Structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. Properties of cyanides and isocyanides, a) hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

Additional Inputs: Basic strength of aliphatic amines and aromatic amines

Unit III (Physical Chemistry) **15 h (1 hr/week)**

S3-P-1: Thermodynamics –I **10 h**

A brief review of - Energy, work and heat units, mechanical equivalent of heat, definition of system, surroundings. First law of thermodynamics statement- various forms of mathematical expression. Thermodynamic quantities- extensive properties and intensive properties, state function and path functions. Energy as a state function and exact differential. Work of expansion and heat absorbed as path function.

Expression for work of expansion, sign convention problems on first law. Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation of Cp-Cv = R. Isothermal adiabatic processes. Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible processes. Problems. Internal energy of an ideal gas. Joule's experiment. Joule-Thompson coefficient. Adiabatic changes in ideal gas, derivation of equation, PV^{γ}= constant. P-V curves for isothermal and adiabatic processes. Heat of a reaction at constant volume and at constant pressure, relation between ΔH and ΔV. Variation of heat of reaction with temperature. Kirchhoff's equation and problems. Limitations of first law and need for second law. Statement of second law of thermodynamics. Cyclic process. Heat engine, Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine. Problems. Thermodynamic scale of temperature.

S3-P-2: Thermodynamics-II **5 h**

Entropy: Definition from Carnot's cycle. Entropy as a state function. Entropy as a measure of disorder. Sign of entropy change for spontaneous and non- spontaneous processes &equilibrium processes. Entropy changes in i) Reversible isothermal process, ii) Reversible adiabatic process, iii) Phase change, iv) Reversible change of state of an ideal gas. Problems. Entropy of mixing of ideal gases. Free energy Gibb's function (G) and Helmholtz'sfunction (A) as thermodynamic quantities. Concept of maximum work and network ΔG as Criteria for spontaneity. Derivation of equation $\Delta G = \Delta H - T\Delta S$. Significance of the equation. Gibbs equations and Maxwell relations. Variation of G with P, V and T.

Unit – IV (General Chemistry) **15 h (1 hr/week)**

S3-G-1 Evaluation of analytical data **4 h**

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors. Problems based on mean, median, range, standard deviation.**Additional Inputs:** Gross errors

S3-G-2: Carbanions-I **5 h**

Introduction, acidic nature of α-hydrogens and tautomerism in carbonyl compounds, nitro hydrocarbons, ethyl acetoacetate, diethyl malonate. Terminal alkynes. Stabilty of carbanions Reactions : Aldol reaction, Perkin reaction, Benzoin condensation, haloform reaction, conversion of smaller alkynes to higher alkynes.

Additional Inputs: Acidic nature of α-Hydrogen of different organic compounds

S3-G-3: Phase Rule 6 h

Statement and meaning of the terms – Phase, Component and Degrees of freedom, Gibb's Phase rule, phase equilibria of one component system – water system. Phase equilibria of two- component system – Solid-Liquid equilibria, simple eutectic –Pb-Ag system, desilverisation of lead. Solid solutions – compound with congruent melting point – Mg-Zn system and incongruent melting point – NaCl-H_2O system.

Additional Inputs: Applications of phase rule

Semester III Course Objectives

To learn the sources, importance, separation techniques of lanthanides

- To understand the basics of formation of coordination compounds from various theories
- Learn the preparation and properties of metal carbonyls and organometallic compounds
- Understand the fundamental properties and reactivity of carboxylic compounds, nitro hydroxy compounds, amines, cyanides and isocyanides
- Understand the various laws of thermodynamic
- Basics of phase rule, number of components and degrees of freedom, eutectic point, eutectic mixture, Water system, Pb-Ag system, NaCl system and freezing mixtures.
- Evaluation of the analytical data
- Reactions involving active methylene compounds
- Synthesis of various organic compounds

COURSE OUTCOMES

Inorganic Chemistry

- Predict the nature of lanthanides and actinides and their influence on the other elements of periodic table
- Analyse the geometry, stability, magnetic properties and isomerism of coordination compounds
- With the basics of 18 valence electron rule, It will help students to predict the stability of metal carbonyls
- Using the knowledge of organo metallic compounds, students can design new synthetic pathways for the synthesis of novel compounds, Hence creating a interest in research and development

Organic Chemistry

- Gains broad knowledge of the preparation and properties of mono, di and unsaturated carboxylic acids with their mechanisms that helps in understanding their importance.
- Reactivity of Nitrogen containing organic compounds and gains the knowledge of preparing various compounds such as dyes

Physical chemistry

- Students will be able to state and apply laws of thermodynamics in predicting the predict the feasibility of a process and extent of yield of the product obtain
- Differentiate between extensive properties and intensive properties, state function and path functions

General Chemistry

- Students will be able to synthesize new compounds from carbon-carbon new bond formation methods learned in carbanions
- Analyse and evaluate the experiment through the analytical data obtained in the observations made
- Use the knowledge of phase rule in the separation of various compounds

Laboratory Course

Paper III (Organic Synthesis) 45 h (3h/week)

1. **Synthesis of Organic compounds:**

i. Acetylation: Acetylation of salicylic acid, Benzoylation of Aniline.

ii. Aromatic electrophilic substitution: Nitration: Preparation of nitrobenzene and m-dinitrobenzene.

iii. Halogenation: Preparation of p-bromo acetanilide, Preparation of 2, 4, 6-tribromo phenol.

iv. Oxidation: Preparation of benzoic acid from benzyl chloride.

v. Esterification: Preparation of n-butyl acetate from acetic acid.

vi. Methylation: Preparation of – β-naphthyl methyl ether.

vii. Condensation: Preparation of benzilidine aniline from Benzaldehyde and aniline.

viii. Diazotization: Azocoupling of β-Naphthol.

2. Microwave assisted synthesis of Asprin – DEMO (demonstration only)

Outcomes of Practicals

- Will learn and implement the ethics of the laboratory rules while performing the experiments
- Develop the skills of handling various instruments such as distillation units, melting point apparatus etc
- Experimental learning in the preparation of various organic compounds that improves their skills in organic synthesis

Semester V

Generic Elective (GE) Course

(4Credits)

(for B.Sc. Non Chemistry/B.A/B.Com Students)

Chemistry of Cosmetics, Food Processing, Drugs and Pharmaceuticals 60Hrs

Unit-I: Chemistry of Cosmetics and Perfumes 15 Hrs

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, sunscreen lotions, lipsticks, talcuin powder. nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to eugenol, geraniol, sandalwood oil, eucalyptus, 2-plienyl ethyl alcohol.

Demonstration experiments or illustration of experimental procedures though charts for the preparation of talcum powder, shampoo and vanishing cream. Chemistry and Applications of deodorants and antiperspirants - Aluminum, Zinc, Boric acid, Chloride and Sulphide.

Unit-II: Food Processing and Food Adulteration 15 Hrs

Food processing: Introduction, methods for food processing, additives and preservatives. Food processing- impact on nutrition,

Food adulteration: Adulterants in some common food items and their identification: Pulses, chilli powder, turmeric powder, milk, honey, spices, food grains and wheat flour, coffee powder, tea leaves, vegetable oil, gliee, ice creams, tomato sauce.

Food Packaging: Definition and function of packaging-Classification of packaging materials- different types of packaging materials such as glass, wood, metal, paper, wood, plastic etc., advantages and disadvantages of each packaging material. Packaging materials and systems: corrugated fibre board boxes, shrink bundles and reusable packages. Effect of packaging materials on nutritive values of food.

Food labelling: Introduction, need and importance.

Unit — III: General Characteristics of Drugs l5Hrs

Introduction: Diseases — causes of diseases, Drug — definition and sources.

ADME of drugs (brief) — Absorption, distribution, drug metabolism (in liver),elimination (brief). Toxicity. Examples (i) Zintac (Ranitidine, antacid) (ii) Paracetamol (antipyretic) (iii) Benadryl (Cough syrup). Characteristics of an ideal drug.

Nomenclature of **Drugs:** chemical name — generic name — trade name. Trade names for the given generic names — (i) Aspirin (ii) Amoxycillin (iii) Ciprofloxacin (iv) ParacetamolM(v) Mebendazole

Drug formulations: Definition — need for conversion of drug into pharmaceutical (drug formulations) — Additives — diluents, binders, lubricants, antioxidants, flavourants, sweeteners, colourants, coating agents. Classification of Drug formulations: oral, parenterals and topical dosage forms —advantages and disadvantages.

i. Oral Dosage forms: Tablets (Aspirin — analgesic; Ciprofloxacin - antibacterial). Capsules (Amoxycillin — antibiotic; Omeprazole-antacid). syrup).

Syrups (B-complex syrup; Benadril- Cough

(ii) Parenterals (Injection forms): Propranolol (antihypertensive), Heparin (anticoagulant)

(iii) Topical dosage forms: Creams and Ointments

(iv) Antiallergic: Aclometasone (Aclovate), Betamethasone valerate(2%) Multiple purposes,

(v) Anti-itching: Doxepin Zonalon), Antifungal: Miconozole (Dactarin, Neomicol), Ketoconazole, (Nizoral Cream), Fluconazole, Anesthetic- Lidocaine, (Lidocaine ointment) and Antiseptic: Boro Plus Cream, For burns -Iodine ointment

Unit - IV: Classification of Drugs 15Hrs

Classification of drugs based on therapeutic action- Chemotherapeutic agents, Pharmacodynamic agents and drugs actilig on iiietabolic processes.

Brief explanation for the following:

(i) **Chemotheraupetic agents:** Antimalarials Chloroquine; Antibiot ic — AmoXICillin; Antitubercular drugs — isoniazide; Antiprotozoa ls — metronidazole.

(ii) Pharmcodynamic agents:

(a) Drugs acting on CNS: Diazepam (CNS depressant), General anesthetic (thiopenta l sodium), antipyretic and analgesic (Iburofen)

(b) Drugs acting on PNS: local anaesthetics (Benzocaine)

(c) Drugs acting on cardiovascular system: Metoprolol (antihypertensive agents), Nefidipine antianginal and antihypertensive agent)

(d) Drugs acting on renal system: Diuretics (Acetazolamide)

(iii) Drugs acting on metabolic processes:

(a) Vitamins: Common name, source, deficiency, vitamin A, B2, B6, C, D, E and K — remedy

(b) Hormones: Function (brief) - deficiency of hormones (Insulin, Testosterone and Osterone)

Course Objectives:

The objective of GE-1 is intended to provide:

- Basic knowledge on cosmetics and perfumes which are used in daily life
- Basic knowledge on adulteration of food
- Have an idea of processing food and packing of food
- Basic knowledge in pharmaceuticals in addition to understand the types of diseases, drugs used to cure specific diseases, concept of ADME, mode of action etc.
- To create interest among the students by illustrating the development of vaccines, drugs etc. that are used in treating common diseases.
- To make them understand the terminology used in pharmaceuticals such as pharmacy, pharmacokinetics, Pharmacodynamics,receptors etc.
- To have a basic knowledge of drug formulation, dosage forms, classification of drugs etc., so that it will be very useful in their day to day life.
- The importance of vitamins, harmones in the growth and development of human body.

B.Sc. Chemistry III Year
Semester-VI, Paper-VI
COURSE CODE: CHE601
Discipline specific elective-A(4 Credits)

Medicinal Chemistry 60Hrs

Unit- I:Introduction and Terminology 15Hrs

S6-E-A-I: Diseases: Common diseases, infective diseases–insect borne, air-borne, water-borne and hereditary diseases.

Terminology in Medicinal Chemistry: Drug, Active pharmaceutical ingridients(API),Phrmaceuticals,Pharmacology, Pharmacophore, Pharmacodyna-mics, Pharmacokinetics, metabolites, anti metabolites and therapeutic index.

Drugs: Nomenclature: Chemical name, Generic name and Trade names with examples;

Classification: Classification based on structures and therapeutic activity with examples.

ADMET: a) Absorption: Definition, absorption of drugs across the membrane – active and passive absorption, routes of administration of drugs. b) Distribution: definition and effect of plasma protein binding. c) Metabolism: definition, phase I and phase II reactions.d) Elimination: definition and renal elimination. e) Toxicity

Unit-II: Enzymes and Receptors 15Hrs

S6-E-A-II: Enzymes: Introduction. Mechanism and factors affecting enzyme action, Specificity of enzyme action (including stereo specificity), Enzyme inhibitors and their importance. Types of inhibition - reversible, irreversible and their subtypes with examples.

Receptors: Introduction, Drug action-receptor theory, Mechanism of drug action, concept of agonists and antagonists with examples. Drug receptor interactions involved in drug receptorcomplex. binding role of –OH group, $-NH_2$ group, quaternary ammonium salts and double bond. Structure – activity relationships of drug molecules, explanation with sulfonamides.

Unit- III: Synthesis and Therapeutic Activity of Drugs 15Hrs

S6-E-A-III: Introduction, synthesis and therapeutic activity of :

Chemotherapeutics: Sulphanilamide, dapsone, Pencillin-G (semi synthesis), Chloroquin, Isoniazid, Cisplatin and AZT.

Drugs to treat metabolic disorders: Anti diabetic - Tolbutamide; Antiinflammatiory – Ibuprofen; Cardiovascular- Glyceryl trinitrate; Antipyretic (paracetamol, aspirin) and Antacid-Omeprazole.

Drugs acting on the nervous system: Anesthetics-definition, Classification-local and general. Volatile- Nitrous oxide, chloroform uses and disadvantages. Local anesthetics – benzocaine.

Unit- IV: Molecular Messengers and Health Promoting Drugs
15Hrs

S6-E-A-IV: Molecular Messengers: Introduction to hormones and neurotransmitters, Thyroid hormones, Antithyroid drug-Carbimazol. Adrenaline: Adrenergic drugs- salbutamol, atenelol. Serotonin: SSRIs- fluoxetine. Dopamine: Antiparkinson drug- Levodopa .

Health promoting drugs: Introduction, sources, Deficiency disorders and remedy of Vitamins A,B, C, D, E K and micronutrients – Na, K, Ca, Cu, Zn and I .

Objectives and outcomes of semester-VI

- Basic knowledge in pharmaceuticals in addition to understand the types of diseases, drugs used to cure specific diseases, concept of ADME, mode of action etc.
- Differentiate the diseases according to the symptoms.
- Classify the drugs based upon chemotherapy, Pharmacodynamics properties.
- Understanding of basic biological and pharmacological interactions
- Use of corresponding knowledge for the development of clinically active drugs
- Drug design and analytical methods
- Relate the structure and physical properties of drugs to pharmacological activity
- Correlating the pharmacology of disease and its cure
- Drug metabolic pathways, adverse effect and therapeutic value of drug
- Chemical synthesis of some drugs
- The importance of vitamins, harmones in the growth and development of human body.

Semester - VI

Laboratory course

Experiments in Physical Chemistry-II

Paper VI (Physical Chemistry) 45hrs (3 h/w)

1. Kinetics

a. Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.

b. Determination of rate of decomposition of hydrogen peroxide catalyzed by $FeCl_3$.

1. Electrochemistry

A. Potentiometry:

b. Determination of redox potential of Fe^{2+}/Fe^{3+} by potentiometric titration of ferrous ammonium sulphate vs. potassium dichromate.

a. Precipitation titration of KCl vs. $AgNO_3$ -Determination of given concentration of silver nitrate.

B. pH metry:

a. pH metric titration of strong acid (HCl) vs. strong base- Determination of the concentration of the given acid.

b. pH metric titration of weak acid(acetic acid) with strong base(NaOH).- Determination of acid dissociation constant (K_a) of weak acid.

1. Conductometry:

Determination of overall order: Saponification of ethyl acetate with NaOH by conductance measurements.

Objectives and outcomes:

- Developed skills in procedures and instrumentations
- Gain knowledge on Principle involved in conductometry, potentiometry and pH metry and their uses in qualitative and quantitative analysis.
- Skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments
- Understanding of the professional and safety responsibilities when working with chemical systems