B.Sc I yr CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2015-2016)

SEMESTER I
Paper – I
Chemistry - I (CHE 101 W)

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

SI-I-1. s-block elements:
Reducing nature of Lithium, diagonal relationship between Li & Mg, Be & Al. **2 h**

SI-I-2. p-block elements: 6 h

Group–13: Boron halides, electron deficiency, Lewis acidity. Synthesis and structure of diborane and higher boranes (B_4H_{10} and B_5H_9), boron-nitrogen compounds ($B_3N_3H_6$ and BN)
Group – 14: Preparation and applications of silanes and silicones.
Group – 15: Preparation and reactions of hydrazine, hydroxylamine, phosphazenes.

SI-I-3. General Principles of Inorganic qualitative analysis 7 h

Anion analysis: Theory of sodium carbonate extract, classification and reaction of anions- CO_3^{2-}, Cl^-, Br^-, CH_3COO^-, NO_3^-, SO_4^{2-}, PO_4^{3-}, BO_3^{3-}..
Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group I individual cations (Hg_2^{2+}, Ag+, Pb+) 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^{2+}), III (Al^{3+}, Fe^{3+}), IV ((Mn^{2+}, Zn^{2+}) individual cations with flow chart and chemical equations. Application of concept of hydrolysis in group V cation analysis. 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+}).

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

S1-O-1: Structural Theory in Organic Chemistry 7 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 or Mesomeric

effect, application to (a) acidity of phenol. (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes. Structure and geometry of carbanions, carbenes and nitrenes.

***Types of organic reactions*:** Addition reactions- electrophilic, nucleophilic and free radical. Substitution reactions – electrophilic, nucleophilic and free radical. Elimination and Rearrangement reactions– Examples(mechanism not required)

S1-O-2: Acyclic Hydrocarbons 8 h

***Alkane*s** –IUPAC Nomenclature of Hydrocarbons. Methods of preparation: Corey-House reaction. Chemical reactivity - inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

Alkenes - Preparation of alkenes (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides (brief mechanism), Zaitsev's rule. Properties: Addition of Hydrogen – heat of hydrogenation and stability of alkenes. Addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H_2O, HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov's addition). Oxidation – hydroxylation by $KMnO_4$, OsO_4, Peracids (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 Diel's – Alder reaction.

Alkynes – Preparation by dehydrohalogenation of dihalides, dehalogenation of tetrahalides. Properties: Acidity of acetylenic hydrogen (formation of metal acetylides) preparation of higher acetylenes, metal-ammonia reductions. Physical properties. Chemical reactivity – electrophilic addition of X_2, HX, H_2O (tautomerism), Oxidation (formation of enediol, 1,2 diones and carboxylic acids), and reduction.

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

S1-P-1: Atomic structure and elementary quantum mechanics 6 h

Failures of classical mechanics, black body radiation, heat capacities of solids, Rayleigh Jeans law, Planck's radiation law, photoelectric effect, Compton effect, De Broglie's hypothesis. Heisenberg's uncertainty principle, sinusoidal wave equation, Hamiltonian operator, Schrodinger's wave equation and its importance. Physical interpretation of the wave function, significance of ψ and ψ^2, a particle in a box, energy levels, wave functions and probability densities. Schrodinger wave equation for H-atom. Separation of variables, radial and angular functions, hydrogen like wave functions, quantum numbers and their importance.

S1-P-2: Gaseous State 5 h

Deviation of real gases from ideal behaviour. Van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO_2.

The Van der Waal's equation and critical state. Derivation of relationship between critical constants and van der Waal's constants. Experimental determination of critcal constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquefaction 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 4 h

Intermolecular forces, structure of liquids (qualitative description). Structural differences between solids, liquids and gases. Surface tension and its determination using 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). Liquid crystals, the mesomorphic state: Classification of liquid crystals in to Smectic and Nematic, differences between liquid crystal and solid / liquid. Application of liquid crystals as LCD devices, lubricants and in digestion/assimilation of food.

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

S1-G-1 Chemical Bonding 11 h

Ionic solids- lattice and solvation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions, covalent nature of ionic bond, covalent bond, stereochemistry of inorganic molecules - Common hybridization and shapes of molecu**les.**

Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of overlapping. Concept of σ and π bonds. Criteria for orbital overlap. LCAO concept. Types of molecular orbitals- bonding, antibonding and non bonding. Electron distribution diagram for H_2, MOED of homonuclear diatomic molecules - H_2, N_2, O_2 , O_2^-, O_2^{2-}, F_2 (unhybridized diagrams only) and heternuclear diatomic molecules CO, CN^- NO, NO^+ and HF. Bond order and magnetic properties.

S2-G-2 Evaluation of analytical data 4 h

Significant figures, accuracy and precision. Errors-classification of errors- determinate and indeterminate errors, absolute and relative errors, propogation of errors in mathematical operations – addition, subtraction, division and multiplication (with respect to determinate errors).

References :

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem.
4. Vogel's Qualitative Inorganic Analysis by Svehla

5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn.
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.
8. Qualitative analysis by Welcher and Hahn.

Unit- II

1. Text book of organic chemistry by Morrison and Boyd.
2. Text book of organic chemistry by Graham Solomons.
3. Text book of organic chemistry by Bruice Yuranis Powla.
4. Text book of organic chemistry by Soni.
5. General Organic chemistry by Sachin Kumar Ghosh.

Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry byLewis Glasstone.

Unit IV

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem

Laboratory Course **45h (3 h / week)**

Paper I (CHE 151 W) Qualitative Analysis - I

I. Preparations:
1.Tetrammine copper (II) sulphate,
2.Potash alum $KAl(SO_4)_2$. $12H_2O$,
3. Bis (dimethylglyoximato) nickel(II)

II. Semimicro analysis of mixtures – Analysis of two cations in the given mixtures

Cations: Ag^+ Pb^{2+} Hg^+ 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+}
Ca^{2+} Sr^{2+} Ba^{2+}
Mg^{2+} NH_4^+

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SEMESTER II
Paper II
Chemistry - II (CHE 201 W)

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

S2-I-1 p-block Elements -II 9 h

Oxides: Types of oxides a) Normal- acidic, basic amphoteric and neutral b) Mixed c) 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 and Cl.

Redox properties of oxyacids of N: HNO2 (reaction with FeSO4, KMnO4, K2Cr2O7), HNO3 (reaction with H2S, Cu), HNO4 (reaction with KBr, Aniline), H2N2O2 (reaction with KMnO4). Redox properties of oxyacids of P: H3PO2 (reaction with HgCl2), H3PO3 (reaction with AgNO3, CuSO4).

Redox properties of oxyacids of S: H2SO3 (reaction with KMnO4, K2Cr2O7), H2SO4 (reaction with Zn, Fe, Cu), H2S2O3 (reaction with Cu, Au), H2SO5 (reaction with KI, FeSO4), H2S2O8 (reaction with FeSO4, KI)

Interhalogens- classification- general preparation- structures of AB,AB_3, AB_5 and AB_7 type and reactivity. Basic iodine- basic nature and evidence of +I and +II . **Poly halides**- definition and structure of ICl_2^-, ICl_4^- and I_3^-. Comparison of **Pseudohalogens** with halogens.

S2-I-2 Chemistry of d-block elements 6 h.

Characteristics of d-block elements with special reference to electronic configuration variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states and e.m.f. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu traids. 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) 15 h (1 hr/week)

S2-O-1: Alicyclic Hydrocarbons (Cycloalkanes) 4 h

Nomenclature, Preparation by Freunds methods, heating dicarboxylic metal salts. properties – reactivity of cyclopropane and cyclobutane by comparing with alkanes Stability of cycloalkanes – Baeyer's strain theory, Sachse and Mohr predictions and

Pitzer's strain theory. Cnformational structures of cyclobutane, cyclopentane and cyclohexane.

S2-O-2: Benzene and its Reactivity 8 h

Concept of aromaticity – aromaticity (definition), Huckel's rule – application to Benzenoid (Benzene, Napthalene, Anthracene and Phenanthracene) and Non – Benzenoid compounds (cyclopropenyl cation, cyclopentadienyl anion and tropylium cation).

Reactions - General mechanism of electrophilic substitution, mechanism of nitration and sulfonation. Mechanism of halogenation, Friedel Craft's alkylation (polyalkylation) and acylation. Orientation of aromatic substitution - Definition of ortho, para, and meta directing groups. Ring activating and deactivating groups with examples. (Electronic interpretation of various groups like NO_2 and Phenolic). Orientation: i. Amino, methoxy and methyl groups. ii. Carboxy, nitro, nitrile, carbonyl and sulfonic acid groups. iii. Halogens (Explanation by taking minimum of one example from each type).

S2-O(II)-2: Arenes and Polynuclear Aromatic Hydrocarbons 3 h

Preparation of alkyl benzenes by Friedel Craft's alkylation, Friedel Craft's acylation followed by reduction, Wurtz-Fittig reaction. Nuclear substitution reactions,side chain substitution reactions and oxidation.
Polynuclear hydrocarbons – Structure of naphthalene and anthracene (Molecular Orbital diagram and resonance energy) Reactivity towards electrophilic substitution. Nitration and sulfonation as examples.

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

S2-P-1: Solutions 4 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, Lever rule. Partially miscible liquids- Phenol – Water, Trimethyl amine – Water and Nicotine –Water systems. Lower upper consolute temperatures. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation. Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law with solvent extraction.

S2-P-2: Dilute Solutions & Colligative Properties 5 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. Experimental methods for determining various colligative properties. Abnormal molar mass, Van't hoff factor, degree of dissociation and assocoation of solutes.

S2-P-3: Solid state Chemistry 6 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 & CsCl (Bragg's method and Powder method). Band theory of Semi-conductors: Extrinsic and intrinsic semiconductors, n-type and p-type and their applications in photo-electro chemical cells.

Classification of materials- classification as metals, ceramics, organic polymers, composites, e.t.c. biological material e.t.c. The property of super conductivity of materials.

Super conducting materials- elements, alloys and compounds. Properties of super conductors- zero resistivity, Meisener effect Ochsenfeld effect and thermal properties. Composites- meaning of composites, advanced composites, classification –particle rein forced fiber reinforced and structural composites general characters of composite materials-Particle- reinforced composites – large particle and dispersion- strengthened composite. Fiber reinforced composites (continuous and discontinuous fiber composites).

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

S2-G-1 Theory of Quantitative Analysis 15 hours

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.

ii) Redox titrations- principle, Oxidation-reduction potentials, standard reduction potential, Nernst's equation. Formal potentials. Redox curves-Ferrous versus ceric, detection of end point, redox indicators- self, internal and external indicators. Use of starch in iodometry. iii) Precipitaion titrations, principle, detection of end point, indicators, Mohr's method and Volhard's method.. iv) Complexation titrations- Ligands, chelate effect, stability constants. principle, Types of EDTA titrations. Titration curves. . Theory of metal ion indicators (EBT and Murexide), use of pH 10 buffer. Titration of mixtures: Suitable control of pH (Pb^{2+} & Ca^{2+}), use of masking and demasking agents (Mg^{2+}, Zn^{2+} & Cu^{2+})

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

References

Unit I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.

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5. Physical Chemistry through problems by S.K. Dogra.
6. Elements of Physical Chemistry by Lewis and Glasstone.
7. Material science by Kakani & Kakani

Unit IV

1. Vogel's Text Book of Quantitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999.
2. Quantitative Analysis by Day and Underwood Prentice Hall (India) VI Edn..

Laboratory Course **45hrs (3 h / week)**

Paper II (CHE 251 W)- Qualitative Analysis - II

I Semi micro analysis of mixtures

Analysis of two anions and two cations in the given mixture.

Anions: CO_3^{2-}, SO_3^{2-}, S^{2-} Cl^-, Br^-, I^- CH_3COO^-, NO_3^- PO_4^{3-}, BO_3^{3-}, SO_4^{2-}

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

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

Mg^{2+} NH_4^+

B.Sc II yr CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2015-2016)
SEMESTER III (CHE 301 W)
Paper-III
Chemistry - III

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

S3-I-1: Chemistry of f-block elements: 6 h
Chemistry of Lanthanides**:** Electronic structure, position in periodic table, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behaviour of post lanthanides- basicity, complexation- type of donor ligands preferred. Magnetic properties- paramagnetism. 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.

S3-I-2: Theories of bonding in metals: 6 h
Valence bond theory, Explanation of metallic properties and its limitations, Free electron theory, thermal and electrical conductivity of metals, limitations, Band theory, formation of bands, explanation of conductors, semiconductors and insulators.

S3-I-3: Non – aqueous solvents 3 h
Classification and characteristics of a solvent. Reactions in liquid ammonia – physical properties, auto-ionisation, examples of ammono acids and ammono bases. Reactions taking place in liquid ammonia – precipitation, neutralization, solvolysis, solvation - solutions of metals in ammonia, complex formation, redox reactions. Reactions in HF – autoionisation, reactions taking place in HF – precipitation, acid – base reactions, protonation.

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

S3-O-1: Halogen compounds 6 hrs
Nomenclature and classification of alkyl (into primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl). Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reaction – classification into S_N1 and S_N2. Mechanism and energy profile diagrams of S_N1 and S_N2 reactions. Stereochemistry of S_N2 (Walden Inversion), S_N1 (Racemisation) explanation of both by taking the example of optically active alkyl halide-2-bromo butane. Structure and reactivity – Ease of hydrolysis - comparison of allyl, benzyl, alkyl, vinyl and aryl halides.

S3-O-2: Hydroxy compounds 6 hrs
Nomenclature and classification of hydroxy compounds. Preparation: from carbonyl

compounds by reduction and Grignard addition . Aryl carbinols by hydroxy methylation. Phenols – (a) by diazotisation (b) from sulfonic acid (c) from cumene (d) by hydrolysis of halobenzene. Physical properties – Hydrogen bonding (inter molecular and intramolecular) effect of hydrogen bonding on boiling point and water solubility Chemical properties (a) acidic nature of Phenols (b) Formation of alkoxide/phenoxides and their reaction with RX (c) replacement of OH by X using PCl_5, $SOCl_2$ and with $HX/ZnCl_2$. Esterification by (a) acid halides, anhydrides and acids (mechanism) (b) Esters of inorganic acids (c) dehydration of alcohols. Oxidation of alcohols by CrO_3, $KMnO_4$. Special reactions of Phenols – (a) Bromination , (b) Kolbe- Schmidt reaction (c) Riemer Tiemann (d) Azo coupling . Identification of alcohols by oxidation - $KMnO_4$, Ceric ammonium nitrate - Lucas reagent; Phenols by reaction with $FeCl_3$, and by the solubility in NaOH. Poly hydroxyl compounds – Pinacol - Pinacolone rearrangement, Oxidatve cleavage ($Pb(OAc)_4$ & HIO_4).

S3-O-3: Ethers and epoxides 3 hrs

Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of conc. H_2SO_4. Physical properties – Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties – inert nature, action of conc. H_2SO_4 and HI. Acid and base catalysed ring opening of epoxides- orientation.

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

S3-P-1: Phase Rule 5 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.

S3-P-2: Colloids, nanomaterials & surface chemistry 10 h

Colloids: Definition of colloids. Classification of colloids. Solids in liquids (sols): preparations and properties. Kinetic, Optical and Electrical stability of colloids, Protective action. Hardy–Schultz law, Gold number. Liquids in liquids(emulsions): Types of emulsions, preparation and emusifier. Liquids in solids(gels); Classification, preparations and properties, inbibition, general applications of colloids. Micelles: Classification of surface active agents. Surfactant action, micellization and micellar interactions, Structure of micelles – spherical and laminar. Critical micellar concentration (CMC). Factors affecting the CMC of surfactants. Counter ion binding to micelles.

Nanomaterials: Nano structured materials – Definition, description of graphite, fullerenes, carbon nano tubes.

Synthetic techniques, bottom-up-sol-gel method, top-down, electro deposition method.

Production of carbon nano tubes – arc discharge, pyrolysis, laser vaporization and electrolysis methods.

Mechanical and electronic properties of carbon nano tubes (CNT)

Properties and applications of nano-materials. Nano material advantage, importance in technological applications

Basics of advanced organic materials and their applications such as in LEDs, OLEDs, etc.

Adsorption: Types of adsorption, Factors influencing adsorption. Freundlich adsorption isotherm. Langmuir theory of unilayer adsorption isotherm. Applications**.**

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

S3-G-1: Symmetry of molecules 3h

Symmetry operations and symmetry elements in molecules. Definition of Axis of symmetry (simple axis (C_n), Plane of symmetry, Center of symmetry and improper rotational axis of symmetry (S_n). Explanation with examples.

S3-G-2: Stereochemistry of carbon compounds 9 h

Isomerism: Definition of homomers and isomers. Classification of isomers: Constitutional and Stereoisomers -. definition and examples. Constitutional isomers: chain, functional, positional isomers and metamerism. Stereoisomers: enantiomers and diastereomers – definitions and examples.

Enantiomers: Optical activity: wave nature of light, plane polarised light, optical rotation and specific rotation. 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). Chiral centers: definition - molecules with similar chiral carbons (Tataric acid) – definition of mesomers. Molecules with dissimilar chiral carbons (2,3-dibromopentane). Number of enantiomers and mesomers - calculation. D, L &, R, S configuration for asymmetric and disymmetric molecules. Cahn-Ingold-Prelog rules. Racemic mixture, Racemisation and Resolution techniques

Diastereomers: Definition - Geometrical isomerism with reference to alkenes – cis, trans and E, Z configuration.

S3-G-3: Conformational analysis 3 h

Classification of stereoisomers based on energy. Definition and examples of conformational and configurational isomers. Conformational analysis of ethane, n-butane, 1,2-dichloroethane,2-chloroethanol and cyclohexane.

Referances:

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.
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3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Colloidal and surface chemistry , M. Satake, Y. Hayashi, Y.Mido, S.A.Iqbal and M.S.sethi
6. Material science by Kakani & Kakani
7. Nano: The Essentials by T. Pradeep, McGraw-Hill Education.
8. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et.al.
9. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press

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1. Text book of organic chemistry by Morrison and Boyd
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3. Text book of organic chemistry by Sony
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5. General Organic chemistry by Sachin kumar Ghosh

Laboratory Course

Paper III (CHE 351W)- Quantitative Analysis - I 45hrs (3 h / week)

Acid - Base titrations

1. Determination of Carbonate
2. Determination of carbonate and bicarbonate in a mixture
3. Estimation of Carbonate in Washing Soda.
4. Estimation of Bicarbonate in Baking Soda.
5. Estimation of Carbonate and Bicarbonate in the Mixture.
6. Estimation of Alkali content in Antacid using HCl.

Redox Titrations

1. Determination of Fe(II) using $K_2Cr_2O_7$
2. Determination of Fe(II) using $KMnO_4$ with sodium oxalate as primary standard.
3. Determination of Cu(II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard

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SEMESTER IV
Paper-IV
Chemistry - IV (CHE 401 W)

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

S4-I-1: Coordination Compounds-I 7 h

Nomenclature – IUPAC rules, simple inorganic molecules and coordination complexes. 1. Brief review of Werner's thoery,Sidgwick's electronic interpretation and EAN rule and defects of both . 2. Coordination numbers, coordination geometries of metal ions, types of ligands. 3. Isomerism in coordination compounds, stereo isomerism- a)geometrical isomerism in i) square planar metal complexes of the type[MA_2B_2], [MA_2BC], [$M(A\text{-}B)_2$], [MABCD]. ii) Octahedral metal complexes of the type [MA_4B_2], [$M(A\text{-}A)_2B_2$], [MA_3B_3] using suitable examples, b) Optical isomerism in i). tetrahedral complexes [MABCD], ii). Octahedral complexes [$M(A\text{-}A)_2B_2$], [$M(A\text{-}A)_3$] using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples. Bonding in coordination compounds 1. Valence bond theory (VBT) – postulates and application to a) tetrahedral complexes $[Ni(NH_3)_4]^{2+}$, $[Ni\ Cl_4]^{2-}$ and $[Ni(CO)_4]$ b) square planar complexes $[Ni(CN)_4]^{2-}$, $[Cu(NH_3)_4]^{2+}$, $[PtCl_4]^{2-}$ c) octahedral complexes $[Cr(NH_3)_6]^{3+}$, $[Fe(CN)_6]^{4-}$, $[Fe\ F_6]^{4-}$, $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$. Limitations of VBT.

S4-I-2:Organometallic Chemistry 4 h

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

S4-I-3: Metal carbonyls and related compounds 4h

EAN rule, classification of metal carbonyls, structure and bonding in metal carbonyls of V, Cr, Mo,W, Mn, Fe, Co and Ni. Preparation and properties of $Ni(CO)_4$. Structure and bonding in Metal nitrosyls.

UNIT - II (Organic chemistry) 15 h (1 hr/week)

S4-O-1: Carbonyl compounds 6 h

Nomenclature of aliphatic and aromatic carbonyl compounds and isomerism.
Synthesis 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 benzal halides Physical properties – absence of Hydrogen bonding . Keto-enol tautomerism, polarisability of carbonyl groups, reactivity

of the carbonyl groups in aldehydes and ketones. Chemical reactivity – i. Addition of [a] $NaHSO_3$ (b) HCN (c) RMgX (d) NH_3 (e) RNH_2 (f) NH_2OH(g) $PhNHNH_2$ (h) 2,4DNP Schiff bases, Addition of H_2O to form hydrate (unstable), comparison with chloral hydrate (stable), addition of alcohols - hemi acetal and acetal formation, Halogenation using PCl_5 with mechanism. Base catalysed reactions with mechanism- Aldol, Cannizaro reaction, Perkin reaction, Benzoin condensation, haloform reaction, Knoevengeal condensation. Oxidation reactions –$KMnO_4$ oxidation and auto oxidation, reduction – catalytic hydrogenation, Clemmenson's reduction, Wolf- kishner reduction, Meerwein Pondoff Verly reduction, reduction with LAH, $NaBH_4$. Analysis – 2,4 –DNP test, Tollen's test, Fehlings test, Scihff's test, haloform test (with equations). Introduction to α,β-unsaturated carbonyl compounds.

S4-O-2: Carboxylic acids and derivatives 6 h

Nomenclature, classification and methods of preparation a) Hydrolysis of Nitrites, amides and esters. b) carbonation of grignard reagents. Special methods of preparation of Aromatic Acids. Oxidation of the side chain of Arenes. Hydrolysis of benzotrichlorides. Kolbe reaction. Physical properties- hydrogen bonding, dimeric association, acidity – strength of acids with the examples of trimethyl acetic acid and trichloro acetic acid, Relative differences in the acidity of Aromatic and aliphatic acids. 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 Huns Diecker reaction, Schmidt reaction (Decarboxylation). Arndt – Eistert synthesis, Halogenation by Hell – Volhard - Zelensky reaction. Carboxylic acid Derivatives – Reactions of acid halides, Acid anhydrides, acid amides and esters (mechanism of ester hydrolysis by base and acid).

S4-O-3: Synthesis based on Carbanions 3h

Acidity of α-Hydrogens, structure of carbanion. Preparation of Aceto acetic ester by Claisen condensation and synthetic application of Aceto acetic ester. [a) Acid hydrolysis and ketonic hydrolysis. Preparation of i] monocarboxylic acids ii) dicarboxylic acids (b) malonic ester – synthetic applications. Preparation of i] substituted mono carboxylic acids ii) substituted dicarboxylic acids. iii) trialkyl acetic acid.

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

S4-P-1: Electrochemistry & EMF 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 K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Electrolyte and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells. 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 – standard electrode potential, sign conventions, electrochemical series and its significance.

Applications of EMF measurements, Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K). Determination of pH using quinhydrone electrode, Solubility product of AgCl. Potentiometric titrations.

Batteries: Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel Cells, Solar cell and polymer cell. Corrosion: cause, factors affecting corrosion and prevention of corrosion.

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

S4-G-1: Pericyclic Reactions 5 h

Pericyclic Reactions: Concerted reactions, Molecular orbitals of ethane,1,3-butadiene and allyl radical. Symmetry properties HOMO, LUMO, Thermal and photochemical pericyclic reactions. Types of pericyclic reactions – electrocyclic, cycloaddition and sigmatropic reactions – one example each and their explanation by FMO theory.

S4-G-2: Synthetic Strategies 5 h

Synthetic strategies: Terminology – Disconnection (dix), Symbol ( ), synthon, synthetic equivalence (SE), Functional group interconversion (FGI), Linear, Convergent and Combinatorial, Target molecule (TM) Retrosynthesis of the following molecules

1) acetophenone 2) cyclohexene 3) phenylethylbromide

S4-G-3: **Asymmetric synthesis 5 h**

Asymmetric (Chiral) synthesis: Definition and classification of stereoslective reactions into substrate, product stereoselective and further into enantio and diastereo selective reactions. stereospecific reaction – definition – example – dehalogenation of 1,2-dibromides by I^-. Enantoselective reactions – definition – example –Reduction of Ethylacetoacetate by Yeast. Diastereoselective reaction-definition-example acid catalysed dehydration of 1-phenylproponal and Grignard addition to chiral carbonyl compound. Definition and explanation of enantiomeric excess, diastereomeric excess.

References :

Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications
2. 1996.
3. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
4. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.
5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn.
6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
7. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.

Unit- II

1. Text book of organic chemistry by Soni.
2. General Organic chemistry by Sachin Kumar Ghosh.
3. Text book of organic chemistry by Morrison and Boyd.
4. Text book of organic chemistry by Graham Solomons.
5. Text book of organic chemistry by Bruice Yuranis Powla.

Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri and Sharma.
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Physical Chemistry through problems by S.K. Dogra.
6. Text Book of Physical Chemistry by R.P. Verma.
7. Elements of Physical Chemistry byLewis Glasstone.
8. Industrial Electrochemistry, D. Pletcher, Chapman & Hall

Unit IV

1. Text book of organic chemistry by Morrison and Boyd
2. Text book of organic chemistry by Graham solomons
3. Fundamentals of organic synthesis and retrosynthetic analysis
4. by Ratna Kumar Kar
5. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav
6. Stereochemistry of organic compounds by D. Nasipuri
7. Organic chemistry by Clayden, Greeves, Warren and Wothers

Laboratory Course

Paper IV (CHE 451W)- Quantitative Analysis - II 45hrs (3h/ week))

Precipitation titration

1. Estimation of Zinc ion by Ferrocyanide.

Complexometry

1.Estimation of Copper by direct titration.
2.Estimation of Nickel by direct titration.
3.Estimation of Nickel by back titration (Standard $MgSO_4$ solution will be given)
4.Estimation of Calcium by substitution titration (Standard $MgSO_4$ solution will be given)
5.Estimation of Lead and Calcium in the mixture.(only estimation)
6.Estimation of Magnesium ion in Talcum powder.
7.Estimation of hardness of Water

Gravimetry:

1. Estimation of Barium as Barium Sulphate
2. Estimation of Nickel as Nickel dimethylglyoxinate

B.Sc III yr CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2015-2016)

SEMESTER V
Paper-V
Chemistry – V (CHE 501 W)

Unit-I (Inorganic Chemistry) 11 h

S5-I-1: Cordination compounds –II 8 h

Crystal field theory (CFT)- Postulates of CFT, splitting patterns of d-orbitals in octahedral, tetrahedral, square planer with suitable examples. Crystalfield stabilization energies and its calculations for various d^n configurations in octahedral complexes. Spectrochemical series . High Spin Low Spin complexes .

Magnetic properties of transition metal complexes- para, dia, ferro , anti ferromagnetic properties, determination of magnetic susceptibility (guoy method), spin only formula, calculations of magnetic moments.

Electronic spectra of metal complexes – colour of transtion elements – d-d transitions.

Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility. and mole ratio

Thermodynamic and kinetic stability of transition of metal complexes . Stability of metal complexes –stepwise and overall stability constant andf their relationship.Factors effecting the stability constants. Chelate effect, determination of composition of complex by Job's method and mole ratio method.

S5-I-2: Boranes and Carboranes: 3 h

Definition of clusters. Structures of boranes and carboranes- Wade's rules and its applications- closo - $[B_nH_n]^{2-}$/ $[B_nC_2H_{n+2}]$: $[B_6H_6]^{2-}$, $[B_{10}H_{10}]^{2-}$, $[B_{10}C_2H_{12}]$. nido - $[B_nH_{n+4}]$ /$[B_nC_2H_{n+4}]$: $[B_5H_9]$, $[B_8H_{12}]$, arachno - $[B_nH_{n+6}]$ / $[B_nC_2H_{n+6}]$: $[B_5H_{11}]$, $[B_7C_2H_{13}]$.

Unit-II (Organic Chemistry) 11 h

S5-O-1: Nitrogen compounds 11 h

Nitro hydrocarbons:

Nomenclature and classification of nitro hydrocarbons. Structure. Tautomerism of nitroalkanes leading to aci and keto form. Preparation of Nitroalkanes . Reactivity - halogenation, reaction with HONO (Nitrous acid), Nef reaction, Mannich reaction, Michael addition and reduction. Aromatic Nitro hydrocarbons: Nomenclature, Preparation of Nitrobenzene by Nitration, from diazonium salts. Physical properties, chemical reactivity – orientation of electrophilic substitution on nitrobenzene. Reduction reaction of Nitrobenzenes in different media.

Amines:

Nomenclature, classification into 1^0, 2^0, 3^0 Amines and Quarternary ammonium compounds. Preparative methods – 1. Ammonolysis of alkyl halides 2. Gabriel synthesis 3. Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties and basic character – Comparative basic strength of Ammonia, methyl amine, dimethyl amine, trimethyl amine and aniline- comparative basic strength of aniline, N- methylaniline and N,N- dimethyl aniline (in aqueous and non- aqueous medium), steric effects and substituent effects. Use of amine salts as phase transfer catalysts. 4. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. 5. Reaction with Nitrous acid of 1^0, 2^0, 3^0 (Aliphatic and aromatic amines). Electophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3^0 Amines, diazotisation. 6. 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, NO_2, H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

Cyanides and isocyanides:

Nomenclature (aliphatic and aromatic) structure. Preparation of cyanides from a) Alkyl halides b) from amides c) from aldoximes. Preparation of isocyanides from Alkyl halides and Amines. 2. Properties of cyanides and isocyanides, a)hydrolysis b) addition of Grignard reagent iii) reduction iv) oxidation.

Unit-III(Physical Chemistry) 11 h

S5-P-1: Chemical Kinetics 11 h

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. Specific reaction rate. Factors influencing reaction rates: effect of concentration of reactants, effect of temperature, effect of pressure, effect of reaction medium, effect of radiation, effect of catalyst with simple examples, order of reaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of 1^{st} order reaction, examples. Decomposition of H_2O_2 and decomposition of oxalic acid.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems.

Second order reaction, derivation of expression for 2^{nd} order rate constant, examples- Hydrolysis of ester, $2O_3$ ---→ $3O_2$, $C_2H_4 + H_2$ ------.> C_2H_6. characteristics of second order reaction, units for rate constants, half- life period and second order plots.

Zero order reaction: derivation of rate expression, examples i)combination of H_2 and Cl_2 to form HCl, ii) thermal decomposition of HI on gold surface characteristics of Zero order reaction units of k, half-life period and graph, problems.

Determination of order of reaction: i) method of integration, ii) half life method, iii) vant-Hoff differential method iv) Ostwald's isolation method.
Kinetics of complex reactions (first order only): opposing reactions, parallel reactions, consecutive reactions and chain reactions.
Problems :Effect of temperature on reaction rate, Arrhenius equation. Temperature coefficient. Concept of energy of activation, determination of energy of activation from Arrhenius equation and by graphical method, problems.Simple collision theory based on hard sphere model explanation of frequency factor, orientation or steric factor. The transition state theory (elementary treatment).

Unit-IV **12 h**

S5-I-3: Applications of coordination compounds **4 h**
Applications of coordination compounds a) in quantitative and qualitative analysis with suitable examples b) in medicine for removal of toxic metal ions and cancer therapy c) in industry as catalysts polymerization – Ziegler Natta catalyst d) water softening .

S5-O-2: Mass Spectrometry **4 h**
Basic principles – Molecular ion / parent ion, fragment ions / daughter ions. Theory – formation of parent ions. Representation of mass spectrum. Identification of parent ion, (M+1), (M+2), base peaks (relative abundance 100%) Determination of molecular formula – Mass spectra of ethylbenzene, acetophenone, n-butyl amine and 1- proponal.

S5-P-2: Photochemistry **4 h**
Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry- Grotthus - Drapper law, Stark – Einsteins Law of photo chemical equivalence.Quantum yield. Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of H_2 – Cl_2 and H_2 – Br_2 reactions, reasons for the high and low quantum yield. Problems based on quantum efficiency, Consequences of light absorptions. Singlet and triplet states. Jablonskii diagram Explanation of internal conversion, inter- system crossing, Phosphorescence, fluorescence. Photo – sensitized reactions examples i)decomposition of hydrogen molecule in the presence of Hg. ii) dissociation of oxalic acid in presence of UO_2^{2+} ion.

References :
Unit- I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications 1996.
2. Concise Inorganic Chemistry by J.D. Lee 3rd edn.
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem.
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A.
5. Keiter and R.L. Keiter 4th edn.

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3. Text Book of Physical Chemistry by Puri, Sharma and Pattania.
4. Physical Chemistry by Atkins & De Paula, 8th Edition
5. Text Book of Physical Chemistry by K. L. Kapoor.
6. Physical Chemistry through problems by S.K. Dogra.
7. Text Book of Physical Chemistry by R.P. Verma.
8. Elements of Physical Chemistry byLewis Glasstone.
9. Basics of Chemical Kinetics by G.L. Agarwal
10. Kinetics and mechanism of chemical transformations by Rajaram & Kuriacose

Unit IV

1. Bioinorganic Chemistry, M.N.Huges
2. Organic spectroscopy, William Kemp
3. Text Book of Physical Chemistry by Puri, Sharma and Pattania.
4. Photochemistry by Gurdeep Raj, Goel publishing house, 5th edition

B.Sc III yr CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2015-2016)

SEMESTER V
Paper-VI
Discipline Centric Elective - I
Spectroscopy, Green Chemistry and Macromolecules (CHE 502 W)

Unit-I
S5-DCEI-1: Molecular spectroscopy 11 h

Electronic spectroscopy:

Interaction of electromagnetic radiation with molecules and types of molecular spectra. Potential energy curves for bonding and antibonding molecular orbitals. Energy levels of molecules (σ,π, n). Selection rules for electronic spectra. Types of electronic transitions:σ-σ*, n-σ*, n-π*, π-π* with suitable examples. λmax in UV spectra measured in nm. Definition of chromophore, auxochrome, bathochromic and hypsochromic shifts. Absorption of characteristic funtional groups: C=C, C-C, C=O, NO_2, COOH. Meaning of extended conjugation and its effect on λmax.

Infra red spectroscopy

Energy levels of simple harmonic oscillator, molecular vibration spectrum, selection rules. Determination of force constant. Qualitative relation of force constant to bond energies. Anharmonic motion of real molecules and energy levels. Modes of vibrations in polyatomic molecules. Characteristic absorption bands of various functional groups. Finger print nature of infrared spectrum.

Raman spectroscopy

Concept of polarizability, selection rules, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Unit – II
S5- DCEI-2: Green chemistry 11 h

Introduction**:** Definition.

Basic principles**:** Prevention of waste, maximum incorporation of reactants, prevention or minimization of Hazardous products . Designing safe chemicals, Energy requirements for synthesis, Selection of solvents, Selection of starting materials,Use of protecting groups ,Use of catalysts,Biodegradable products.

Application of Green Chemistry

a) Green Reagents: Poly NBS. Di Methyl Carbonate

b) Green catalyst: Use of clay as catalyst in Acylation reaction.

c) Microwave induced synthesis: Introduction. eg:- Hydrolysis of Benzyl chloride.Oxidation of toluene & Esterification.

d)Ultra sound assisted Green Synthesis: Introduction.eg:-Cannizaro reaction,Saponification,
e)Biocatalysed Green Synthesis: Synthesis of Semi synthetic pencillin.
f) Aqueous Phase Reactions: Diels- Alder reaction.
g) Ionic liquids as solvents
h) Organic Synthesis in solid state: Dehydration of Alcohols. Bromination and Nitration of aromatic compounds.
Synthesis of drugs involving basic principles of Green Chemistry: eg :- Ibuprofen, Paracetamol.

Unit-III

S5-DCEI-3: Macromolecules-I **11 h**

Definition of polymers – natural polymers and synthetic polymers examples classification as plastics, fibers, elastomers. (brief review)
Thermosetting, thermoplastic polymers. Branched, cross-linked and co-polymers.
Definition of polymerization-addition and condensation polymerization with examples.
Explanation :chain polymerization, step polymerization, co-polymerization and co-ordination polymerization. Kinetics of free radical polymerization. Kinetics and mechanism of linear stepwise polymerization, cationic, anionic polymerization. Polymerization in homogeneous and heterogeneous systems. Bulk, solution, suspension and emulsion polymerizations.
Tacticity, atacticity, stereo specific synthesis- Zeigler- Natta catalyst.
Molecular weight definitions- number average, weight average molecular weight
Determination of molecular weight of polymers using viscosity method, Osmometric method & light scattering technique. Problems.

Unit-IV **12 hrs**

S5-DCEI-4:Spectrophotometry **4 h**

General features of absorption – spectroscopy, Beer-Lambert's law and its limitations, transmittance, Absorbance, and molar absorptivity. Single and double beam spectrophotometers. Application of Beer-Lambert law for quantitative analysis of

1. Chromium in $K_2Cr_2O_7$
2. Manganese in manganous sulphate
3. Iron (III) with thiocyanate.

S5-DCEI-5: Heterocyclic compounds **4 h**

Introduction and definition: Simple 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring systems – presence in important natural products like hemoglobin and chlorophyll. Numbering the ring systems as per Greek letter and Numbers. Aromatic character – 6- electron system (four-electrons from two double bonds and a pair of non-bonded electrons from the hetero atom). Tendency to undergo substitution reactions.

Resonance structures: Indicating electron surplus carbons and electron deficient hetero atom. Explanation of feebly acidic character of pyrrol, electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example). Sulphonation of thiophene purification of Benzene obtained from coal tar). Preparation of furan, Pyrrole and thiophene from 1,4,- dicarbonyl compounds only, Paul-Knorr synthesis, structure of pyridine, Basicity – Aromaticity – Comparison with pyrrole – one method of preparation and properties – Reactivity towards Nucleophilic substitution reaction – chichibabin reaction.

S5-DCEI-6: Macromolecules-II **4 h**

Polymer Processing: Moulding, compounding, blending. Polymer designing: packaging, certification and process evaluation.

Preparation and industrial applications of polyethylene, poly vinyl chloride (PVC), nylon –66, teflon, polyacrylonitrile and terelene. Conducting polymers- intrinsically and extrinsically conducting polymers with examples. Introduction to biodegradability.

References :

Unit- I

1. Fundamentals of Molecular Spectroscopy, Banwell and McCash.
2. Introduction to Molecular Spectroscopy, G.M. Barrow
3. Absorption Spectroscopy of Organic Compounds, J.R. Dyer
4. Organic spectroscopy by William Kemp.

Unit- II

1. Green Chemistry – V.K.Ahluwalia
2. New trends in Green Chemistry –by V.K.Ahluwalia & M.Kidwai

Unit III

1. Contemporary Polymer Chemistry, H. R. Alcock & F. W. Lambe, Prentice Hall
2. Polymer science by Gowrikar
3. Polymers by G.S. Misra
4. Polymer Science by Billmeyer

Unit IV

1. Analytical Chemistry, David Krupadanam
2. A Text book of pharmaceutical formulations by Mithal
3. Introduction to pharmaceuticals by A.K.Gupta and S.S.Bajaj
4. Physical Chemistry of Polymers, A. Tagers, Mir Publishers
5. A text book of polymers, Vol. I,II,III, M.S. Bhatnagar , S. Chand

B.Sc III yr CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2015-2016)

SEMESTER V
Discipline Centric Elective - II
Paper-VI
Applied Analysis, Natural Products and Fuel Chemistry (CHE 502 W)

Unit-I
S5-DCEII-1: Applied Analysis - I 11 hrs
a) Analysis of water: Water pollution, water pollutants and their sources, determination of physicochemical parameters, acidity, alkalinity and hardness. Determination of BOD, COD & DO
b) Analysis of soil : Analysis of soils for available Major Nutrients - Estimation of available Nitrogen (Kjeldahl Method), Phosphorus (Olsen's Method and Bray and Kurtz Method), and Exchangeable Calcium & Magnesium (by EDTA).
c). Analysis of Food: Analysis of Chemical Additives in foods : Division of colour additives, quantitative estimation of added dyes in foods (Titanium Trichloride Method) - chemical preservatives and synthetic sweetening agents .Analysis of SO2& Sodium Benzoate (Chemical Methods), Food adulteration- Common adulteration in food, contamination of food stuff.
Microscopic examination of foods for adulterants .

Unit – II
S5- DCEII-2: Natural Products - 1 11 h

Terpenoids and alkaloids:
Introduction, Classification of terpenoids and carotenoids, alkaloids, General methods in the structure determination of terpenes, Isoprene rule, structure determination and synthesis of α-terpeniol and β-carotene. General methods in the structure determination of alkaloids, structure determination and synthesis of papaverine and quinine

Unit-III
S5- DCEII -3: Fuel Chemistry - 1 11 h
Review of energy sources (renewable and non-renewable). Conventional energy resources: Chemical fuels, classification, (solids, liquids, gaseous). Solid fuels: coal, analysis of coal, proximate and ultimate analysis and their significance. Uses of coal (fuel and non fuel) in various industries, its composition, carbonization of coal.Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro Gasification and Catalytic gasification), Coal liquefaction and Solvent Refining. *Liquid fuels*: Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation

(Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Synthetic petrol- Bergius and FischerTropsch's process, knocking, anti knocking agents, octane number. *Diesel fuel:* Cetane number. Other liquid fuels: LPG, biodiesel, kerosene, fuel oil, benzol, tar, power alcohol. Gaseous fuels: natural gas, coal gas, producer gas, oil gas, water gas, biogas, Combustion: Calorific value and its determination, bomb calorimeter. HCV and LCV values of fuels, problems. analysis of flue gas by Orsats method. Rocket fuels, solid propellants, liquid propellants, monopropellants, bipropellants *Non conventional energy resources:* Nuclear fuels- nuclear reactor, nuclear fission, nuclear fusion, sources of nuclear fuels, disposal of radioactive wastes, reprocessing of nuclear fuels, solar, hydro, wind, tidal energies. Bio fuels, H_2 as a non polluting fuel.

Unit-IV **12 h**

S5- DCEII- 4: Applied Analysis - II **4 h**

Analysis of Oils and fats **4hrs**

Formulae of fattay acids, compostion of some common oils and fats,compostion of some drying oils, compostion of peanut oil, seasame oil, caster oil, butter fat ,animal fat.
Classification of oil, drying oils, semi-drying oils ,non drying oils, waxes
saponification value,acid value, Iodine value. uses of oils and fats.

S5- DCEII- 5: Natural Products – 1I **4 h**

Flavonoids

Introduction, classification, occurrence, Isolation of flavonoids, General methods of structure determination, Synthesis of flavonoids- flavonones, flavonols and chalcones

S5- DCEII- 6: Fuel Chemistry - II **4 h**

Petrochemicals & Fuelcells:

Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.
Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.
*Fuel cells***:** H_2/O_2 and methanol/O_2 fuel cells. Use of porous electrodes in fuel cells. Advantages and limitations of fuel cells. Photovoltaic cells. Semiconductor based photoelectrochemical cells. Electrochemical energy from solar energy.

Reference books:

Unit I & Unit IV

1. Environmental Pollution Analysis, S M Khopkar, Wiley Eastern Ltd 1995.
2. Environmental Analytical Chemistry, F W Fifield, P J Haines, Blackie Academi Professional.

3. Environmental Chemistry, B K Sharma, Goel Publishing House, Meerut.
4. Handbook of Analysis and quality control for fruit and vegetable products, S Ranganna, Tata Mc Graw Hill Publishers Ltd, 1986.
5. Introduction to chemical analysis of foods, S Suzanna & Nielsen, CBS Publishers & Distributors.

Unit II & Unit IV
Natural Producs

1. Chemistry of Natural products– V.K.Ahluwalia
2. Organic Chemistry by O.P Agarwal
3. Organic Chemistry by I.L. Finar
4. Chemistry of Natural productd by Bhatt, Nagasampagi and Sivakumar

Unit III & Unit IV
Fuel Chemistry – I & II

1. Text book of Engineering Chemistry by C.P. Murthy, C.V. Agarwal & A. Naidu: B.S. Publications, Hyderabad (2006).
2. Text book of Engineering Chemistry by S.S. Dara: S. Chand & Co. New Delhi (2006).
3. Engineering Chemistry by B. Siva Shanker : Mc-Graw Hill publishing Company Limited, New Delhi (2006)
4. Engineering Chemistry by J.C. Kuriocose & J. Rajaram: Tata McGraw Hill Co. New Delhi (2004)
5. Engineering Chemistry by P.C. Jain & Monica Jain, Dhanpatrai publishing company,(2008)
6. Chemistry of Engineering Materials by C.V. Agarwal, C.P. Murthy & A. Naidu: BS publications
7. Chemistry of Engineering Materials by R.P. Mani & K.N. Mishra, CENGAGE learning
8. Applied Chemistry – A text book of engineering and Technology – Springar (2005)
9. Text book of Engineering Chemistry by Shasi Chawla: Dhanpatrai Publishing company, New Delhi (2008)
10. Engineering Chemistry by R. Gopalan, D. Venkatappayya & D.V. Sulochana Nagarajan – Vikas Publishers (2008).

Laboratory Course:

Paper V(Organic Chemistry) (CHE 551W) 45 h (3h/w)

1. **Synthesis of Organic compounds:**

   Acetylation: Acetylation of salicylic acid, Benzoylation of Aniline.

   Aromatic electrophilic substitution: Nitration: Preparation of nitro benzene and m-dinitro benzene.

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

   Oxidation: Preparation of benzoic acid from benzyl chloride.

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

   Methylation: Preparation of β- naphthyl methyl ether.

   Condensation: Preparation of benzilidine aniline and Benzaldehyde and aniline.

   Diazotisation: Azocoupling of β-Naphthol.

2. **Thin layer Chromatography**
   Determination of Rf values and identification of organic compounds: preparation and separation of 2,4-dinitrophenyl hydrazones of acetione and 2-butanone using toluene and light petroleum(40:60)
   Separation of ortho & para nitro aniline mixtures

3. **Microwave assisted synthesis of organic compounds – DEMO (demonstration only)**

Paper VI (Physical Chemistry) (CHE 552W) 45hrs (3 h / w)

Distribution law

1. Determination of distribution coefficient of iodine between water and carbon tetrachloride/determination of molecular status and partition coefficient of benzoic acid in Toluene and water.
2. Determination of distribution coefficient of acetic acid between n-butanol and water.

2. Electrochemistry

1. Determination of concentration of HCl conductometrically using standard NaOH solution.
2. Determination of concentration of acetic acid conductometrically using standard NaOH solution.
3. Determination of cell constant of conductivity cell.
4. Determination of dissociation constant (K_a) of acetic acid by conductivity measurements.
5. Determination of solubility and solubility product of $BaSO_4$

Adsorption

1. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

Physical constants

1 Surface tension and viscosity of liquids

B.Sc III yr CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2015-2016)

SEMESTER VI
Paper-VII
Chemistry - VI (CHE 601 W)

Unit-I (Inorganic Chemistry) 11 h

S6-I-1:Inorganic reaction mechanisms 4h

Labile and inert complexes, ligand substitution reactions – S_N1 and S_N2 in Octahedral complexes; substitution reactions of square planar complexes – Trans effect and applications of trans effect.

Reactions of tetrahedral complexes - Hydrolysis of silicon halides and phosphorous oxides.

S6-I-2:Bioinorganic chemistry 7h

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (Cl^-).

Toxic metal ions As, Hg & Pb

Oxygen transport and storage – structure of haemoglobin , binding and transport of oxygen.

Fixation of CO_2 in photosynthesis- overview of light and dark reactions in photosynthesis. Structure of chlorophyll and coordination of magnesium. Electron transport in light reactions from water to $NADP^+$ (Z – scheme).

Fixation of N_2 by nitrogenase – biological fixation . Comparison of nitrogen fixation by nitrogenase and Haber's process.

UNIT - II (Organic Chemistry) 11 h

S6-O-1: Carbohydrates 6 h

Introduction: Classification and nomenclature – classification into mono, oligo and polysacchrides, into pentoses, hexoses etc., into aldoses and ketoses.

Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Evidences for straight chain pentahydroxy aldehyde structure (Acetylation, reduction to n- hexane, cyanohydrin formation, reduction of Tollen's and Fehling's reagents and oxidation to gluconic and saccharic acids). Number of optically active, isomers possible for the structure, configuration of glucose based on D-glycealdehyde as primary standard (No proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehyde tests and mutarotation). Cyclic structure of glucose: Proposition of cyclic structure (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). Different ways of writing pyranose structure (Haworth formula and chair conformational formula). Structure of fructose: Evidence of 2 – ketohexose structure (formation of penta acetate,

formation of cyanohydrin its hydrolysis and reduction by HI to give 2-Carboxy-n-hexane) Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure , Haworth formula).
Inter Conversion of Monosaccharides: Aldopentose to aldo hexose – eg: Arabinose to D-glucose, D- mannose (kiliani – Fischer method). Epimers, Epimerisation- Lobry de bruyn van Ekenstein rearrangement. Aldohexose – Aldopentose eg: D-glucose to D-arabinose by Ruff's degradation. Aldohexose(+) (glucose) to ketohexose (–)(fructose) and Ketohexose(Fructose) to aldohexose (Glucose).

S6-O-2 Amino acids and proteins 5 h

Classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, valine and Leucene) by following methods: a) From halogenated Carboxylic acid b)Malonic ester synthesis c) strecker's synthesis.Physical properties: Optical activity of naturally occurring amino acids: L – configuration, irrespective of sign of rotation. 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, peptide synthesis

Unit-III (Physical Chemistry) 11 h

S6-P-1:Thermodynamics -I 11h

Energy, work and heat units, mechanical equivalent of heat, definition of system, surroundings. I law of thermodynamics statement- various forms mathematical expression. Thermodynamic quantities- extensive properties and intensive properties, state function, 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 I law.
Heat changes at constant pressure and heat changes at constant volume. Enthalpy. Heat capacities at constant pressure and constant volume. Derivation Cp-Cv = R.
Isothermal adiabatic processes. Reversible and irreversible processes. Reversible change and maximum work. Derivation of expression for maximum work for isothermal reversible process. Problems. Internal energy of an ideal gas. Joules experiment and 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. Kirchoff's equation and problems. Limitations of I law and need for II law. Statement of II law of thermodynamics. Cyclic process. Heat engine, Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine problems. Thermodynamic scale of temperature.

Unit-IV **12 h**

S6-I-3:Hard and soft acids bases (HSAB) **4h**

Classification, Pearson's concept of hardness and softness, application of HSAB principles – Stability of compounds / complexes, predicting the feasibility of reaction

S6-O-3: Proton Magnetic Resonance Spectroscopy **4h**

Proton magnetic resonance spectroscopy

Principles of nuclear magnetic resonance, shielding and deshielding, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals – spin-spin coupling, coupling constants. Applications of NMR with suitable examples – ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

S6-P-2: Thermodynamics- II **4 hrs**

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 inert perfect gases. Free energy Gibb's function (G) and Helmholtz's function (A) as thermodynamic quantities. Concept of maximum work and net work ΔG as criteria for spontaneity. Derivation of equation $\Delta G = \Delta H - T\Delta S$. significance of the equation. Gibbs equations and the Maxwell relations. Variation of G with P, V and T.

References :

Unit- I

1. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.
2. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn.
3. Reaction mechanisms, K.Veera Reddy.

Unit- II

1. Text book of organic chemistry by Soni.
2. General Organic chemistry by Sachin Kumar Ghosh.
3. Text book of organic chemistry by Morrison and Boyd.
4. Text book of organic chemistry by Graham Solomons.
5. Text book of organic chemistry by Bruice Yuranis Powla.

Unit III

1. Principles of physical chemistry by Prutton and Marron.
2. Text Book of Physical Chemistry by Soni and Dharmahara..
3. Text Book of Physical Chemistry by Puri, Sharma and Pattania.
4. Physical Chemistry by Atkins & De Paula, 8th Edition
5. Text Book of Physical Chemistry by K. L. Kapoor.
6. Physical Chemistry through problems by S.K. Dogra.
7. Text Book of Physical Chemistry by R.P. Verma.
8. Elements of Physical Chemistry byLewis Glasstone.
9. Thermodynamics by Rajaram

Unit IV

1. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001.
2. Organic Spectroscopy, William Kemp
3. Principles of physical chemistry by Prutton and Marron.
4. Text Book of Physical Chemistry by Soni and Dharmahara..
5. Text Book of Physical Chemistry by Puri, Sharma and Pattania.
6. Thermodynamics by Rajaram

B.Sc III yr CHEMISTRY
SEMESTER WISE SYLLABUS
(For the batch admitted in 2015-2016)

SEMESTER VI
Paper-VIII
(Discipline centric Interdisciplinary paper)
Separation Techniques, Drugs and Catalysis (CHE 602 W)

Unit-I **11 h**

S6-ID-1: Separation Techniques-I

Chromatography:

Classification of chromatography methods, principles of differential migration.

Paper Chromatography: Principles, Rf values, experimental procedures, choice of paper and solvent systems, developments of chromatogram – ascending, descending and radial. Two dimensional chromatography, applications.

Thin layer Chromatography (TLC): Advantages. Principles, factors effecting Rf values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.

Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation technique. Applications

High Performance Liquid Chromatography (HPLC): Principles and Applications.

Gas Liquid Chromatography (GLC): Principles and Applications

Ion Exchange Chromatography: Theory, action of cation and anion exchange resins. Applications

Unit-II **11 h**

S6-ID-2: Drugs -I **11 h**

Introduction: Drug, disease (definition), Historical evolution, Sources – Plant, Animal synthetic, Biotechnology and human gene therapy

Terminology: Pharmacy, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics (ADME, Receptors – brief teartment) Metabolites and Anti metabolites.

Nomenclature: Chemical name, Generic name and trade names with examples

Classification: Classification based on structures and therapeutic activity with one example each.

Synthesis: Synthesis and therapeutic activity of the following drugs, sulphanilamide, Asprin,L-Dopa, Chloroquin, Omeprazole, ciprofloxacin, paracetamol, Acyclovir and AZT

Drug Development: Pencillin, Separation and isolation, structures of different pencillins.Pencillin-G,V, Ampicillin and amoxicillin.

Monographs of drugs: Eg Paracetamol, Sulpha methoxazole (Tablets)

Unit-III **11 h**

S6-ID-3:Catalysis -I **11 h**

Homogeneous and heterogeneous catalysis- Definition of a catalyst and catalysis. Comparison of homogeneous and heterogeneous catalysis with specific examples. General characteristics of catalytic reactions

Acid- Base catalysis- examples of Acid catalysed and Base catalysed reactions, Hydrolysis of esters. Kinetics of acis catalysed reactions. Specific acid and general acid catalysis, Kinetics of base catalysed reaction. Specific base and general base catalysis. Examples- aldol condensation and decomposition of nitramide. base catalyzed conversion of acetone to diacetone alcohol. Effect of pH on reaction rates of acid and base catalysed reactions.

Enzyme catalysis- characteristics of enzyme catalysis (i)Invertase in inversion of cane sugar (ii)maltase in coversion of maltose to glucose (iii) urease in decomposition of urea (iv) zymase in converion of glucose to ethanol etc. vi). carbonicanhydrase. Kinetics of enzyme catalysed reactions Michaelis- Menten law. Mechanism of enzyme catalysed reactions. Significance of Michaelis constant (K_m)and maximum velocity (V_{max}), Burkweaver and Eadie-Hofsee plots. Factors affecting enzyme catalysis. (i)effect of Temperature (ii)effect of pH(iii)effect of concenteration and (iv)effect of inhibitor on enzyme catalysed reactions. Catalytic efficiency. Mechanism of oxidation of ethanol by alcohol dehydrogenase.

Unit-IV **12 h**

S6-ID-4: Separation Techniques-II **4 h**

Solvent Extraction:

Principles and process of solvent extraction. Distribution coefficient, distribution ratio, problems. Techniques of solvent extraction- Batch extraction of liquids continuous extraction of liquids. Counter current extraction.Advantages of solvent extraction techniques. Extracting separation of metal ions as chelates. Application – Determination of Iron (III)

S6-ID-5: Drugs-II

Formulations **4 h**

Introduction: Need of conversion of drugs into medicine. Additives and their role (brief account only).

Classification: Classification of formulations with example.

Development: Formulation of ciprofloxacin as an example

S6-ID-6: Catalysis-II **4 h**

Phase-transfer catalysis (PTC): Principles of phase-transfer catalysis. PTC classification. Role of water in phase-transfer catalyzed reactions. Factors influencing the rate of PTC reactions. Inverse phase transfer catalysis. Mechanism of nucleophilic displacement reactions. Crown ethers. Crown ethers as PTCs in the reaction of alkyle halides with super oxide. Permanganate oxidation of alkenes and phenols in the presence of quarternary ammonium salts and crown ethers as PTCs.

References :

Unit- I

1. Analytical Chemistry, David Krupadanam
2. Vogel's Text Book of Quantitative Analysis by G.H.Jeffery, J.Bassett,
3. J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999.
4. Fundamentals of analytical chemistry, Skoog & West

Unit- II

1. Synthetic Drugs by O.D.Tyagi & M.Yadav
2. Medicinal Chemistry by Ashutoshkar
3. Medicinal Chemistry by P.Parimoo
4. Medicinal Chemistry by Kadametal P-I & P.II
5. Drugs by David Krupadanam
6. Pharmacology & Pharmacotherapeutics by R.S Satoshkar & S.D.Bhandenkar
7. Pharmacodynamics by R.C.Srivastava, Subit Ghosh
8. European Pharmacopoeia

Unit III

1. Physical Chemistry by Atkins & De Paula, 8th Edition
2. Physical Chemistry by Puri, Sharma & Pattania
3. Kinetics and mechanism of chemical transformations by Rajaram & Kuriacose
4. Text Book of Physical Chemistry by K. L. Kapoor.
5. Catalysis, J. C. Kuriacose, Macmillan

Unit IV

1. Analytical Chemistry, David Krupadanam
2. Drugs by David Krupadanam
3. Phase Transfer Catalysis, Fundamentals, Applications and Industrial perspective, C. M. Stark, C. Liotta & M. Halpern, Academic Press
4. Phase Transfer Catalysis, E. V. Dehmlow & S. S. Dehmlow, Verlag Chemie, Weinheim

Laboratory Course

Paper-VII (Organic) (CHE 651W) 45hrs (3 h / w)

Organic Qualitative Analysis:

Qualitative Analysis*:* Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

(carboxylic acids, phenols, amines, carbonyl compounds, amides, esters,nitrohydrocarbon, polynuclear hydrocarbon, carbohydrates and urea) Demonstration of extraelemental test for N, X & S.

Separation of two component mixtures (demonstration only)
1) Aniline+Naphthalene 2) Benzoic acid +Benzophenone 3) p-Cresol +Chlorobenzene.

Project Work:

Collection of spectral data of a minimum of six compounds belonging to different functional groups (other than those included in the syllabus) and submission of the report.

NOTE: 5 marks will be awarded to project work instead of regular practical assessment.

Paper VIII (Physical Chemistry) (CHE 652W) 45hrs (3 h / w)

Chemical kinetics

1. Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.
2. Determination of rate of decomposition of hydrogen peroxide.
3. Determination of overall order of saponification of ethyl acetate.

Electrochemistry

1. Determination of concentration of HCl potentiometrically using standard NaOH solution.

2. Determination of redox potentials of Fe^{2+}/Fe^{3+} by potentiometric titration of ferrous ammonium sulphate vs. potassium dichromate.
3. Preparation phosphate buffer solutions
4. pH metric titration of weak acid, acetic acid with strong base NaOH and calculation of dissociation constant.

Colorimetry

1. Verification of Beer-Lambert law for $KMnO_4$ and determination of concentration of the given solution.
2. Verification of Beer-Lambert law for $CuSO_4$ and determination of concentration of the given solution.
3. Composition of complex of Cu^{2+} - EDTA disodium salt