Telangana 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 2025-2026

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+2P=6	4+1=5
BS 105	Optional II	DSC-2A	4T+2P=6	4+1=5
BS 106	**Optional III- Chemistry - I**	**DSC-3A**	**4T + 2P = 6**	**4 + 1 =5**
	Laboratory Course – I (Qualitative Analysis - Semi Micro Analysis of Mixtures)			
	Total Credits		**28**	**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+2P=6	4+1=5
BS 205	Optional II	DSC-2B	4T+2P=6	4+1=5
BS 206	**Optional III- Chemistry - II**	**DSC-3B**	**4T + 2P = 6**	**4 + 1 =5**
	Laboratory Course - II (Quantitative Analysis – Titrations)			
	Total Credits		**28**	**25**

SECOND YEAR- SEMSTER III

Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND COMMERCE, SAINIKPURI, SECUNDERABAD. Autonomous College
Affiliated to OSMANIA UNIVERSITY, Hyderabad.
(Accredited with 'A' grade by NAAC)
Department of Chemistry

Program: **B Sc** **Mb,G,C**
Bt.Mb.C
Bt,G,C
Mb,N&D,C

Subject: Chemistry-I
COURSE CODE: CT135 & CT135P
YEAR/SEMESTER: I/I
(60 h/ 15 weeks)

HPW:4
No. Of Credits: Theory – 4
Practical –1

SEMESTER-1
COURSE OBJECTIVES

COb1

- This unit enables students to learn various theories of bonding both ionic and covalent. Familiarize with the treatment of bonding in VB theory, understand hybridisation of orbitals, apply the VSEPR theory to determine the structure of small polyatomic molecules. Acquire a knowledge of MOED.
- Identify the basic principles related to structure and bonding in s and p –block elements.

COb2

- This unit introduces the students to three foundation courses (a) the basic ideas of structural theory in organic chemistry and its applications, (b) preparation and reactions of alkanes, alkenes, alkynes – the first family of hydrocarbons, and (c) theory of aromaticity, reactivity of aromatic compounds and substituent effects.

COb3

- Understand the differences between gases and liquids. Derive vander waals laws.
- Identify the properties of various kinds of liquid-liquid solutions and their deviation from ideal behaviour.

COb4

- Acquire qualitative skills for semi micro analysis of double salts.

The stereochemistry part in the unit aims to teach the students three basic concepts - (a) various methods of representing 3-dimensional structures of organic molecules, (b) the concept of isomerism in organic molecules and classification based on superimposability, molecular connectivity, non-superimposable mirror image relationship, and energy barrier, and (c) conformational analysis of simple ethane

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derivatives and cyclohexane.

- To identify and apply the concepts involved in the structure and physical properties of crystalline inorganic solids.

UNIT I-Inorganic Chemistry-I — **15 h (1 h /w)**

1. Chemical Bonding — 8 h
2. p-Block Elements-I — 7 h

UNIT II-Organic Chemistry-I — **15 h (1 h / w)**

1. Structural Theory in Organic Chemistry — 5 h
2. Acyclic Hydrocarbons — 6 h
3. Aromatic Hydrocarbons — 4 h

UNIT III-Physical Chemistry-I — **15 h (1 h / w)**

1. Atomic structure and elementary quantum mechanics — 2h
2.. Gaseous State — 5h
3. Liquid State — 4h
4. Solutions — 4h

UNIT IV - General Chemistry-I — **15 h (1 h / w)**

1. General principles of Inorganic qualitative analysis — 6 h
2. Stereochemistry -I — 5 h
3. Solid state Chemistry — 4 h

YEAR/SEMESTER: I/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 Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of bonding. Criteria for orbital overlap. LCAO concept. Sigma and pi overlapping. Concept of types of molecular orbitals-bonding, antibonding and nonbonding. MOED of homo nuclear diatomic - H_2,N_2,O^{2-},O_2^{2-},F_2 and heteronuclear diatomics (unhybridized diagrams only) CO, CN^-, NO, NO^+ and HF. Bond order, stability and magnetic properties.

S1-I-2. p-Block Elements 1 — **7h**

Group–13: Structure of diborane and higher Boranes (B_4H_{10} and B_5H_9), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3.
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, hydroxyl amine, phosphazenes.

Unit - II (Organic Chemistry) — **15h (1 h/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 carbocations. Resonance - Mesomeric effect, application to (a) acidity of phenol. (b) acidity of

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carboxylic acids and basicity of anilines. Stability of carbo cations, carbanions and free radicals. Sigma bond lecolization and its application to stability of carbocations, 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 H_2O, HOX, H_2SO_4 with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov's addition). Oxidation (cis – additions) – hydroxylation by by $KMnO_4$, OsO_4
anti addition- peracids (via epoxidation), hydroboration, ozonolysis – determining the 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 diho alkenes, dehalogenation of tetrahalides. 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 (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 **2 h**

Black body radiation, 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 CO_2. 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 **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).

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S1-P-4: 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, Trimethyl amine – 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-} CH_3COO^- Cl^- Br^- I^- 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^{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+},Ca^{2+} Sr^{2+} with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg^{2+}, NH_4^+).

S1-G-2. Stereochemistry-I **5 h**

Shapes of organic molecules – Various methods of representing 3-dimensional structures – Wedge, Fischer, Newman and Sawhorse formulae – Meaning, advantages and limitations of each formula.

Isomers - Flow chart for classification - Definition and examples of homomers, isomers, constitutional isomers, stereo-isomers, enantiomers, diastereomers, configurational stereoisomers (enantiomers and diastereomers) and conformational stereoisomers (enantiomers and diastereoisomers)

Conformations of ethane, n-butane, 1,2-dichloroethane, 2-chloroethanol, 1,2-dihydroxyethane - conformational stability - energy diagrams.

Baeyer's strain theory in cycloalkanes - Puckered structures - cyclohexane conformations – chair and boat forms – flipping of chair forms – energy diagram – equatorial and axial bonds.

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. X-ray diffraction by crystals; Derivation of Bragg's equation. Determination of structure of NaCl, KCl and CsCl (Bragg's method and Powder method).

COURSE OUTCOMES:

CT135.CO1

- Apply the concept of LCAO to construct MOED for simple diatomic molecules and calculate their bond order magnetic property.

  Predict the synthesis and bonding properties of s and p block elements.

CT135.CO2

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- The students are expected to know the methods of C – C, C=C and C=C bond formation, reagents and respective name reactions; the difference in reactivity of single, double and triple bonds; the meaning and use of reaction mechanisms with examples; the theory of aromaticity, aromatic compounds and their reactivity; difference from acyclic conjugated alkenes.

CT135.CO3

- The student will know non-ideal behaviour of gases, PV isotherms, van der Waal's equation and critical phenomenon. They should be familiar with methods used to liquefy gases.

  Identify different separation techniques and apply them in chemical analysis.

CT135.CO4

- Apply the knowledge of semi micro analysis in identification of ions in many substances.
- Correlate and predict the structure –composition of various inorganic solids.

The student should be able to write Fischer, Newman and Sawhorse formulae of simple Ethane derivatives and their inter-conversion; determine isomeric relationship between two molecules; types of isomers; strain theory in cycloalkanes; conformations of cyclohexane and types of bonds; flipping of chair forms and energy considerations.

Laboratory Course: Paper code: CT135P:
Qualitative Analysis:

Objective:

- To identify the anions & cations in different salt mixtures using a systematic scheme of semi-micro technique.

Laboratory Course **30h (2 h / week)**

Paper I - Qualitative Analysis - Semi micro analysis of mixtures

Qualitative Analysis - Semi micro analysis of mixtures Analysis of two anions (one simple, one interfering) and two cations in the given mixture.

Anions: CO_3^{2-}, Cl^-, Br^-, I^-, CH_3COO^-, NO_3^-, PO_4^{3-}, $^-$, SO_4^{2-}.

Cations: Pb^{2+},Hg^{2+},Cd^{2+}, Bi^{3+}, Al^{3+}, Fe^{3+},Co^{2+},Zn^{2+}, Mn^{2+} Ba^{2+}, Sr^{2+}, Ca^{2+},Mg^{2+}, NH_4^+

Outcome:

- Learn to identify the presence of anions and cations in salt mixtures using systematic semi-micro analytical method
- Students learn to use some green reagents and green techniques during the analyses

Text books:

Unit - I: Concise Inorganic Chemistry by J.D. Lee 3rd edn
Unit- II: Organic Chemistry by Morrison and Boyd 6th edn
Unit- III: Physical Chemistry by P.L. Soni

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Unit- IV: Vogel's Text Book of Qualitative Analysis by G.H.Jeffery, J.Bassett, J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999

Reference books: B.Sc.I Year Chemistry : Semester I

Unit- I

1. Inorganic chemistry by P.L. Soni & others..
2. Basic Inorganic Chemistry by F.A.Cotton, Wilkinson and Paul.L. Gaus 3rd edn Wiley Publishers 2001. Chem
3. Inorganic Chemistry Principles of structure and reactivity by James E.Huheey, E.A. Keiter and R.L. Keiter 4th edn.
4. Inorganic Chemistry by Shriver and Atkins 3rd edn Oxford Press 1999.

Unit- II

1. Organic Chemistry by Graham Solomons.
2. Organic Chemistry by John McMurry.
3. Organic Chemistry by Soni.
4. General Organic chemistry by Sachin Kumar Ghosh.

Unit III

1. Text Book of Physical Chemistry by Soni and Dharmahara.
2. Text Book of Physical Chemistry by Puri and Sharma.
3. Text Book of Physical Chemistry by K. L. Kapoor.
4. Principles of physical chemistry by Prutton and Marron.

Unit IV

1. Vogel's Qualitative Inorganic Analysis by Svehla
2. Text Book of Organic Chemistry by Graham Solomons.
3. Text Book of Organic Chemistry by Soni.
4. Text Book of Physical Chemistry by Puri And Sharma.
5. Text Book of Physical Chemistry by K. L. Kapoor.

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Department of Chemistry

Program: B Sc — Mb,G,C / Mb,Bc,C / Bt,G,C / Mb,N&D,C

Subject: Chemistry-II
COURSE CODE: CT235 & CT235P
YEAR/SEMESTER: I/II
(60 h/ 15 weeks)

HPW:4
No. Of Credits: Theory – 4
Practical –1

SEMESTER-11
COURSE OBJECTIVES

COb1

- To use the knowledge of p, d block and zero group elements to interpret structure and reactivity of compounds. Students learn in detail about oxyacids, Pseudohalogens and interhalogen compounds. They are able to distinguish the properties of transition and inner transition elements.

COb2

- This unit introduces the study of three most important functional groups – halo, hydroxyl, and carbonyl; and the students are expected to learn the preparation, properties and reactions of halogen compounds, alcohols, ethers, aldehydes and ketones; their inter-conversion by chemical methods and all the related name reactions – Mechanisms of reactions and stereochemical implications.

COb3

- This unit is designed to learn the fundamentals of electrochemistry and the applications of electrochemical methods. They use this knowledge to distinguish between electrolytic and galvanic cells.
- To relate the concept of electrochemistry, working and reactions of different electrochemical cells.

COb4

- To discuss concepts of principles involved in qualitative analysis of ions, basics in Stereochemistry of organic compounds.
- The first part of this unit expects to teach students the principles involved in the quantitative analysis.
- The second course of the unit is about chiral organic molecules, criteria for chirality, optical activity, molecules with one or more chiral carbons (centres), configuration at the chiral carbon, definitions of asymmetric and dissymmetric molecules.

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- To describe the relationship between solute concentration and physical properties of a solution.

UNIT I-Inorganic Chemistry-II	15 h (1 h / w)
1. p-block Elements -II	7 h
2.Chemistry of Zero group elements	2 h
3. Chemistry of d-block elements	6 h
UNIT II-Organic Chemistry-II	15 h (1 h / w)
1.Halogen compounds	4 h
2. Hydroxy compounds and ethers	6 h
Carbonyl compounds	5 h
UNIT III-Physical Chemistry-II	15 h (1 h / w)
1. Electrochemistry	15 h
UNIT IV- General Chemistry-II	15 h (1 h / w)
1. Theory of Quantitative Analysis	6 h
2. Stereochemistry – II	5 h
3.Dilute Solutions & Colligative Properties	4 h

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 (c) sub oxide (d) peroxide e) superoxide. Structure of oxides of C, N, P, S and Cl-reactivity. 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 KMnO4). 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: Comparision 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 behavior 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 traids. Titanium triad –

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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 S_N^1 and S_N^2 Mechanism and energy profile diagrams of S_N^1 and S_N^2 reactions. Stereochemistry of S_N^2 (Walden Inversion) 2-bromobutane, S_N^1 (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: Preparation: 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/$ZnCl_2$ (Lucas reagent), esterification, oxidation with PCC, alk. $KMnO_4$, acidic dichromates,conc.HNO_3 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, Schotten-Boumann reaction, Houben-Hoesch condensation, .
Ethers: Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of conc. H_2SO_4. Chemical properties – inert nature, action of conc. H_2SO_4 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) $NaHSO_3$ (b) HCN (c) RMgX (d) NH_3 (e) RNH_2 (f) NH_2OH (g) $PhNHNH_2$ (h) 2,4-DNP (Schiff bases). Addition of H_2O to form hydrate , chloral hydrate (stable), addition of alcohols - hemi acetal and acetal formation. Cannizaro reaction. Oxidation reactions-$KMnO_4$ oxidation and auto oxidation, reduction – catalytic hydrogenation, mechanism of Clemmenson's reduction, Wolf- kishner reduction, Meerwein Pondoff Verly reduction. Reduction with LAH, $NaBH_4$.

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

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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 EMFand 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 h /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($KMnO_4$) 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: Stereochemistry- II **5 h**

Chiral molecules: definition and criteria - absence of plane, center and Sn axis of symmetry - Optical activity: Definition, wave nature of light, plane polarised light, optical rotation and specific rotation — Asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and dissymmetric molecules (trans1,2-dichlorocyclopropane). Molecules with more than one chiral carbons - constitutionally similar and dissimilar chiral carbons – examples - Tartaric acid, 2,3-dibromopentane; meso-compounds, D, L nomenclature and R, S – configuration: Cahn-Ingold-Prelog rules – examples.

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.

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COUSRE OUTCOMES:

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

CT235.CO1

- Implement the basics of p-block elements to interpret acidity of oxyacids and appraise the trends in d block elements.

CT235.CO2

- The student will be familiar with identification of halogen, hydroxyl and carbonyl functional groups in the molecules, synthesis and reactions of halohydrocarbons, alcohols, aldehydes and ketones; and conversions of one class of compound to the other by means of chemical reactions and interpret the mechanism involved.

CT235.CO3

- Write equations representing electrochemical cell and calculate electrochemical parameters

CT235.CO4

- At the end of this course, the student will be able to identify whether a molecule is chiral or not by symmetry criteria; the number of stereo isomers possible for a chiral molecule; and the absolute configuration at the chiral centre(s); and the theory of optical activity and internal compensation.

Laboratory Course Paper code: CT235P
Paper II - Quantitative Analysis

Objective:

- Acquire quantitative skills in volumetric analysis and gain knowledge about the neutralisation, redox and complexometric titrations

Laboratory Course **30hrs (2 h / week)**
Paper II- Quantitative 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_4^+ by back titration

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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Complexometric Titrations:
1. Estimation of Mg^{2+}
2. Estimation of Cu^{2+}

Outcome:

- Able to prepare standard solutions.
- Find the concentrations of unknown solutions

Text books:
Unit - I: Concise Inorganic Chemistry by J.D. Lee 3rd edn
Unit- II: Organic Chemistry by Morrison and Boyd.
Unit- III: Physical chemistry by P.L Soni
Unit- IV: Vogel's Text Book of Qualitative Analysis by G.H.Jeffery, J.Bassett,J.Mendham and R.C. Denney 5th edn Addison Wesley Longman Inc. 1999

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2. Organic Chemistry by John McMurry.
3. Organic Chemistry by Soni.
4. General Organic chemistry by Sachin Kumar Ghosh.

Unit III
1. Text Book of Physical Chemistry by Soni and Dharmahara.
2. Text Book of Physical Chemistry by Puri and Sharma.
3. Text Book of Physical Chemistry by K. L. Kapoor.
4. Elements of Physical Chemistry by Lewis Glasstone.
5. Principles of physical chemistry by Prutton and Marron

Unit IV
1. Vogel's Qualitative Inorganic Analysis by Svehla
2. Text Book of Organic Chemistry by Morrison And Boyd.
3. Text Book of Organic Chemistry by Graham Solomons.
4. Text Book of Organic Chemistry by Soni.
5. Text Book of Physical Chemistry by Puri And Sharma.
6. Text Book of Physical Chemistry by K. L. Kapoor.

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