## 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 2019-2020

	B.Sc., Chemistry from 2	019-2020		
FIRST YEAR- SEMSTER I				
	COURSE TITLE	COURSE	HPW	CREDITS
=======================================	Ability E-L	TYPE		- 2
	Ability Enhancement Compulsory Course AECC-1 English	ES	2	2
\$2-21 to \$2- to \$	Second language	CC-1A	4	4
	Optional I	· CC-2A	4	4 .
	Optional II	DSC-1A	4T+3P=7	4+1=5
	Optional III. Charles	DSC-2A	4T+3P=7	4+1=5
	Optional III- Chemistry - I		4T ]	47 -
	Laboratory Course – I	DSC-3A	} = 7	<b>├</b> =5
	(Qualitative Analysis)		3P J	1-2
	Total Credits		31	25
BS 201	Ability Enhanced FIRST YEAR- SEMST	ER II		
BS 202	Ability Enhancement Compulsory Course AECC-2 English	BCS	2	2
BS 203	Second language	CC-1B	4	4
BS 204	Optional I	CC-2B	4	4
BS 205	Optional II	DSC-1B	4T+3P=7	4+1=5
BS 206	Optional II	DSC-2B	4T+3P=7	4+1=5
DD 200	Optional III- Chemistry - II			
	Laboratory Course - II	DSC-3B	4T)	47
	( Quantitative Analysis)		= 7	<b>├</b> =5
	m		3P)	1-/
	Total Credits		31	25
BS 301	SECOND YEAR- SEMST			
20 001	Ruleshir Chemistry Laboratory and Lab Reagents Remedial methods for pollution, drinking water and	SEC-1	2	2
	Soil fertility	SEC-2	2	2 .
BS 302	English	00.10		
BS 303	Second language	CC-1C	3	3
BS 304	Optional I	CC-2C	3	3
BS 305	Optional II	DSC-1C	4T+3P=7	4+1=5
BS 306	Optional III- Chemistry - III	DSC-2C	4T+3P=7	4+1=5
25 5 6 6	Laboratory Course - III			
	(Synthesis of Organic compounds)	DGG 2G	4T ]	47
	(Symmesis of Organic compounds)	DSC-3C	= 7	<u></u>
	Total Credits		3P )	1
	SECOND YEAR- SEMST	ED IV	31	25
BS 401	Materials and their Applications			
	Chemistry of Cosmetics and Food Processing	SEC-3 SEC-4	2	2
3S 402	English		2	2 ·
3S 403	Second language	CC-1D	3.	3
3S 404	Optional I	CC-2D	3	3
	Optional II	DSC-1D	4T+3P=7	4+1=5
and the second s	Optional III- Chemistry - IV	DSC-2D	4T+3P=7	4+1=5
	Laboratory Course - IV	Dec an	4T ]	47
		DSC-3D	<b>\}</b> = 7	<b>→</b> = 5
	Qualitative and Spectral Analysis of Organic Compounds)  Total Credits		3P J	1
	Total Credits		31	25

AECC: Ability Enhancement Compulsory Course, SEC: Skill Enhancement Course, DSC: Discipline Specific

Course, GE: Generic Elective, ES: Environmental Science, BCS: Basic computer skills.

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#### B.Sc I Yr CHEMISTRY SEMESTER WISE SYLLABUS SEMESTER I

Paper – I Chemistry - I

#### Unit-I (Inorganic Chemistry) S1- I-1. Chemical Bonding

15 h (1 hr/week) 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<sup>2</sup>, sp<sup>3</sup>, sp<sup>3</sup>d, sp<sup>3</sup>d<sup>2</sup> and sp<sup>3</sup>d<sup>3</sup>, shapes of molecules. Molecular orbital theory: Shapes and sign convention of atomic orbitals. Modes of bonds. Criteria for orbital overlap. LCAO concept.  $\pi$  and  $\sigma$  overlapping. Concept of Types of molecular orbitals- bonding, antibonding and non bonding. MOED of homonuclear diatomics - H<sub>2</sub>, N<sub>2</sub>,  $O_2^-$ ,  $O_2^{2-}$ , F<sub>2</sub> (unhybridized diagrams only) and heteronuclear diatomics CO,  $CN^-$ , NO,  $NO^+$  and HF. Bond order, stability and magnetic properties.

#### S1-I-2. p-Block Elements 1

7 h

Group-13: Structure of diborane and higher Boranes ( $B_4H_{10}$  and  $B_5H_9$ ), Boron nitrogen compounds ( $B_3N_3H_6$  and BN), Lewis acid nature of BX<sub>3</sub>. 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 hr/week)

#### S1-O-1: Structural Theory in Organic Chemistry

5 h

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

#### S1-O-2: Acyclic Hydrocarbons

6 h

Alkanes- Methods of preparation: From Grignard reagent, Kolbe synthesis. Chemical reactivity - inert nature, free radical substitution, Halogenation example- reactivity, selectivity and orientation.

Alkenes - Preparation of alkenes (with mechanism) (a) by dehydration of alcohols (b) dehydrohalogenation of alkyl halides (c) by dehalogenation of 1,2 dihalides, Zaitsev's rule. Properties: Anti-addition of halogen and its mechanism. Addition of HX, Markonikov's rule, addition of H<sub>2</sub>O, HOX, H<sub>2</sub>SO<sub>4</sub> with mechanism and addition of HBr in the presence of peroxide (anti – Markonikov's addition). Oxidation (cis – additions) – hydroxylation by KMnO<sub>4</sub>, OsO<sub>4</sub>,

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anti addition- peracids (via epoxidation), hydroboration, ozonolysis – location of double bond.

Dienes – Typos of discoverage (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 Dieles. butadiene and Diels - Alder reaction.

Alkynes- Preparation by dehydrohalogenation of vicinal dihalides, dehalogenation of tetrahalides. Physical Properties: Chemical reactivity – electrophilic addition of X<sub>2</sub>. HX, H<sub>2</sub>O (tautomerism). On the Properties: Chemical reactivity – electrophilic addition of X<sub>2</sub>. HX, H<sub>2</sub>O (tautomerism), Oxidation (formation of enediol, 1,2 diones and carboxylic acids) and reduction (Metal-ammonia reduction, catalytic hydrogenation).

## Aromatic Hydrocarbons

4h

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

## Unit - III (Physical Chemistry)

15h(1 hr/week)

## S1-P-1: Atomic structure and elementary quantum mechanics

3 h

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

S1-P-2: Gaseous State

5 h

Deviation of real gases from ideal behavior. van der Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO2. The van der Waal's equation and critical state. Derivation of relationship between critical constants and van der Waal's constants. The law of corresponding states, reduced equation of states. Joule Thomson effect and inversion temperature of a gas. Liquifaction of gases: i) Linde's method based on Joule Thomson effect ii) Claude's method based on adiabatic expansion of a gas.

#### S1-P-3: Liquid State and Solutions

4h

Liquid State

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

**Solutions** 

Liquid - liquid mixtures, ideal liquid mixtures, Raoult's and Henry's laws. Non ideal systems. Azeotropes: HCl-H<sub>2</sub>O and C<sub>2</sub>H<sub>5</sub>OH - H<sub>2</sub>O systems. Fractional distillation. Partially miscible liquids: Phenol - Water, Trimethyl amine - Water and Nicotine - Water systems.

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## Unit - IV (General Chemistry)

15h(1 hr/week)

## SI-G-1, General Principles of Inorganic Qualitative Analysis

6 h

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Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions-  $CO_3^{2-}$ ,  $CI^-$ ,  $Br^-$ ,  $SO_4^{2-}$ ,  $PO_4^{3-}$ ,  $BO_3^{3-}$ ,  $CH_3COO^-$ ,  $NO_3^-$ . Interfering ions, Cation Analysis: Principles involved - Solubility product, common ion effect, general discussion for the separation and identification of group 1 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  $(Hg^{2+}, Pb^{2+}, Bt^{3+}, Cd^{2+}, Sb^{3+})$ , III  $(Al^{3+}, Pe^{3+})$ , IV  $(Mn^{2+}, Zn^{2+})$  individual cations with flow chart and chemical equations. General discussion for the separation and identification of group V individual cations  $(Ba^{2+}, Sr^{2+}, Ca^{2+})$  with flow chart and chemical equations, Theory of flame test, Identification of Group VI cations  $(Mg^{2+}, NH_4^+)$ .

S1-G-2. Isomerism

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

Conformational analysis: Classification of stereoisomers based on energy. Definition and examples Conformational and configurational isomers. Conformational analysis of ethane, n-butane, 1,2- dichloroethane,2-chloroethanol .Cyclic compounds: Bacyer's strain theory, Conformational analysis of cyclohexane

Cis-trans isomerism: E-Z-Nomenclature

#### S1-G-3: Solid state Chemistry

4 h

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

#### References

General reference: B.Sc I Year Chemistry: Semester I, Telugu Academy publication, Hyd 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.

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5. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey,

E.A. Keiter and R.L. Keiter 4m edn.

- 6. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press 1989.
- 7. Inorganic Chemistry by Shriver and Atkins 3rdedn Oxford Press 1999.

9. Textbook of Inorganic Chemistry by R Gopalan.

#### Unit- II

- Organic Chemistry by Morrison and Boyd.
- 2. Organic Chemistry by Graham Solomons.
- 3. Organic Chemistry by Bruice Yuranis Powla.
- 4. Organic Chemistry by L. G. Wade Jr.
- 5. Organic Chemistry by M. Jones, Jr
- 6. Organic Chemistry by John McMurry.
- 7. Organic Chemistry by Soni.
- 8. General Organic chemistry by Sachin Kumar Ghosh.
- 9. Organic Chemistry by C N pillai

#### 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. Qualitative analysis by Welcher and Hahn.
- 2. Vogel's Qualitative Inorganic Analysis by Svehla.
- 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.
- 6. Text Book of Organic Chemistry by Soni.
- 7. Text Book of Physical Chemistry by Soni And Dharmahara...
- 8. Text Book of Physical Chemistry by Puri And Sharma.
- 9. Text Book of Physical Chemistry by K. L. Kapoor.

#### **Laboratory Course**

45h (3 h / week)

#### Paper I - Qualitative Analysis - Semi micro analysis of mixtures

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

Anions:  $CO_3^{2-}$ ,  $SO_3^{2-}$ ,  $S^{2-}$ ,  $Cl^-$ ,  $Br^-$ ,  $l^-$ ,  $CH_3COO^-$ ,  $NO_3^-$ ,  $PO_4^{3-}$ ,  $BO_3^{3-}$ ,  $SO_4^{2-}$ . Cations:  $Hg_2^{2+}$ ,  $Ag^+$ ,  $Pb^{2+}$ 

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

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

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

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

 $Mg^{2+}$ ,  $NH_4^+$ 

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### B.Sc I Yr CHEMISTRY SEMESTER WISE SYLLABUS

SEMESTER II

Paper – II Chemistry - II

Unit-I (Inorganic Chemistry)

S2-I-1 p-block Elements -II

15 h (1 hr/week)

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, Cl and I. Redox properties of oxyacids of Nitrogen: HNO<sub>2</sub> (reaction with FeSO<sub>4</sub>, KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), HNO<sub>3</sub> (reaction with H<sub>2</sub>S, Cu), HNO<sub>4</sub> (reaction with KBr, Aniline), H<sub>2</sub>N<sub>2</sub>O<sub>2</sub> (reaction with KMnO<sub>4</sub>). Redox properties of oxyacids of Phosphorus: H<sub>3</sub>PO<sub>2</sub> (reaction with HgCl<sub>2</sub>), H<sub>3</sub>PO<sub>3</sub> (reaction with AgNO<sub>3</sub>, CuSO<sub>4</sub>). Redox properties of oxyacids of Sulphur: H<sub>2</sub>SO<sub>3</sub> (reaction with KMnO<sub>4</sub>, K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>), H<sub>2</sub>SO<sub>4</sub> (reaction with Zn, Fe, Cu), H<sub>2</sub>S<sub>2</sub>O<sub>3</sub> (reaction with Cu, Au), H<sub>2</sub>SO<sub>5</sub> (reaction with KI, FeSO<sub>4</sub>), H<sub>2</sub>S<sub>2</sub>O<sub>8</sub> (reaction with FeSO<sub>4</sub>, KI). Redox properties of oxy acids of Chlorine.

Interhalogens- Classification- general preparation- structures of AB, AB<sub>3</sub>, AB<sub>5</sub> and AB<sub>7</sub> type and

**Poly halides**- Definition and structure of  $ICl_2^-$ ,  $ICl_4^-$  and  $I_3$ .

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 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 hrs

Classification: alkyl (primary, secondary, tertiary), aryl, aralkyl, allyl, vinyl, benzyl. Chemical reactivity - reduction, formation of RMgX, Nucleophilic substitution reactions classification into  $S_N1$  and  $S_N2$ . Mechanism and energy profile diagrams of  $S_N1$  and  $S_N2$ reactions. Stereochemistry of S<sub>N</sub>2 (Walden Inversion) 2-bromobutane, S<sub>N</sub>1 (Racemisation) 1bromo-1-phenylpropane Structure and reactivity - Ease of hydrolysis - comparison of alkyl, vinyl, allyl, aryl, and benzyl halides.

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Alcohols: Preaparation: 1°, 2° and 3° alcohols using Griganard reagent, Reduction of Carbonyl compounds, carboxylic acids and esters. Physical properties: H-bonding, Boiling point and Solubility. Reactions with Sodium, HX/ZnCl<sub>2</sub> (Lucas reagent), esterification, oxidation with PCC, alk. KMnO<sub>4</sub>, acidic dichromates, conc. HNO<sub>3</sub> and Oppenauer oxidation (Mechanism).

Phenols: Preapartion: (i) from diazonium salts of anilines, (ii) from benzene sulphonic acids and (iii) Cumene hydroperoxide.

Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution; halogenations, Riemer Tiemann reaction (Mechanism), Kolbe reaction (Mechanism), Gattermann-Koch reaction, Azo-coupling reaction, Schotton-Boumann raction, Houben-Hoesch condensation, .

Ethers: Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of conc. H<sub>2</sub>SO<sub>4</sub>. Physical properties – Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties - inert nature, action of conc. H<sub>2</sub>SO<sub>4</sub> and HI.

### S2-O-3 Carbonyl compounds

5h

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 benzal halides Physical properties - absence of Hydrogen bonding. Reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of (a) NaHSO<sub>3</sub> (b) HCN (c) RMgX (d) NH<sub>3</sub> (e) RNH<sub>2</sub> (f) NH<sub>2</sub>OH (g) PhNHNH<sub>2</sub> (h) 2,4-DNP (Schiff bases). Addition of H<sub>2</sub>O to form hydrate, chloral hydrate (stable), addition of alcohols - hemi acetal and acetal formation. Cannizaro reaction. Oxidation reactions - KMnO4 oxidation and auto oxidation, reduction - catalytic hydrogenation, mechanism of Clemmenson's reduction, Wolfkishner reduction, Meerwein Pondoff Verly reduction. Reduction with LAH, NaBH4.

#### Unit - III (Physical Chemistry)

15h(1 hr/week)

#### S2-P-1: Electrochemistry

15 h

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

Electrolytic and Galvanic cells - reversible and irreversible cells, conventional representation of electrochemical cells. Electro motive force (EMF) of a cell and its measurement. Computation of EMF. Types of reversible electrodes- the gas electrode, metal-metal ion, metal-insoluble

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salt and redox electrodes. Electrode reactions, Nernst equation, cell EMF and single electrode potential Standard Victorial Sta electrode potential, Standard Hydrogen electrode – reference electrodes (calomel electrode) – standard electrode potential - standard electrode potential, sign conventions, electrochemical series and its significance. Applications of EMF measurements. Calculation of thermodynamic quantities of cell reactions (Gibbs from reactions (Gibbs free energy G, Helmholtz free energy and Equilibrium constant K).

Determination of all research and rese Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode. Solubility product of AgCl. Potentiometric titrations.

## Unit - IV (General Chemistry)

15 h (1 hr/week)

S2-G-1: Theory of Quantitative Analysis

6 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 acidstrong base and weak acid -weak base. Theory of redox titrations - internal(KMnO4) and external indicators – use of diphenylamine and ferroin indicators. Theory of complexometric titrations - use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations - theory of adsorption indicators.

Gravimetric analysis- Introduction, nucleation, precipitation, growth of precipitate, filtration and washing, drying and incineration of precipitate, coprecipitation and post precipitation.

Determination of Ni<sup>2</sup>

#### S2-G-2: Stereoisomerism

5h

Optical activity: Definition, wave nature of light, plane polarised light, optical rotation and specific rotation, chiral centers. Chiral molecules: definition and criteria - absence of plane, center and S<sub>n</sub> axis of symmetry - asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and disymmetric molecules (trans-1,2-dichlorocyclopropane). Molecules with constitutionally symmetrical chiral carbons (Tartaric acid) Molecules with constitutionally unsymmetrical chiral carbons (2,3dibromopentane). D, L configuration - examples. R, S - configuration: Cahn-Ingold-Prelog rules, examples for asymmetric and disymmetric molecules.

#### S2-G-3: Dilute Solutions & Colligative Properties

4 h

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

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#### References

General reference: B.Sc 1 Year Chemistry : Semester II, Telugu Academy publication, Hyd Unit I

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications1996.

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.
- 4. Chemistry of the elements by N.N.Greenwood and A. Earnshaw Pergamon Press1989.

5. Inorganic Chemistry by Shriver and Atkins 3rdedn Oxford Press 1999.

- 6. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th Edn.
- Textbook of inorganic chemistry by R Gopalan.

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- 6. Organic Chemistry by John McMurry.
- 7. Organic Chemistry by Soni.
- 8. General Organic chemistry by Sachin Kumar Ghosh.
- 9. Organic Chemistry by C N pillai

#### Unit III

- 1. Physical chemistry by P W Atkins
- 2. Principles of physical chemistry by Prutton and Marron.
- Text Book of Physical Chemistry by Soni and Dharmahara.
- 4. Text Book of Physical Chemistry by Puri and Sharma
- 5. Text Book of Physical Chemistry by K. L. Kapoor
- 6. Physical Chemistry through problems by S.K. Dogra.
- 7. Elements of Physical Chemistry by Lewis and Glasstone.
- 8. 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..
- 3. Nano: The Essentials by T. Pradeep, McGraw-Hill Education.
- 4. Chemistry of nanomaterials: Synthesis, Properties and applications by CNR Rao et.al.
- 5. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press
- 6. Practical chemistry by V K Ahluwalia, Sunitha Dhingra and AdarshGulati.

Laboratory Course

**Paper II- Quantitative Analysis** 

45hrs (3 h / week)

#### 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.

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- Estimation of Alkali content in Antacid using HCl.
- Estimation of NH<sub>4</sub><sup>+</sup> by back titration

#### Redox Titrations

Determination of Fe(II) using K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>

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

3. Determination of Cu(II) using Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> with K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> as primary standard

#### Complexometric Titrations

- 1. Estimation of Mg<sup>2+</sup>
- 2. Estimation of Cu<sup>2+</sup>

#### B.Sc II Yr CHEMISTRY SEMESTER WISE SYLLABUS SEMESTER III Paper-III Chemistry - III

#### Unit-I (Inorganic Chemistry)

15 h (1 hr/week)

5 h

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

Chemistry of Lanthanides: Position in periodic table, Electronic structure, oxidation state, ionic and atomic radii- lanthanide contraction- cause and consequences, anomalous behavior of post lanthanides-complexation- type of donor ligands preferred. Magnetic propertiesparamagnetism. 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: Coordination Compounds-I

6h

Simple inorganic molecules and coordination complexes. Nomenclature - IUPAC rules, 1. Coordination number, coordination geometries of metal ions, types of ligands. 2.Brief review of Werner's theory, Sidgwick's electronic interpretation and EAN rule and their limitations. (Valence bond theory (VBT) - postulates and application to (a) tetrahedral complexes [Ni(NH<sub>3</sub>)<sub>4</sub>]<sup>2+</sup>, [NiCl<sub>4</sub>]<sup>2-</sup> and [Ni(CO)<sub>4</sub>] (b) Square planar complexes [Ni(CN)<sub>4</sub>]<sup>2-</sup>, [Cu(NH<sub>3</sub>)<sub>4</sub>]<sup>2+</sup>, [PtCl<sub>4</sub>]<sup>2-</sup> (c) Octahedral complexes [Fe(CN)<sub>6</sub>]<sup>4-</sup>, [Fe(CN)<sub>6</sub>]<sup>3-</sup>, [FeF<sub>6</sub>]<sup>4-</sup>, [Co(NH<sub>3</sub>)<sub>6</sub>]<sup>3+</sup>, [CoF<sub>6</sub>]<sup>3-</sup> Limitations of VBT. 3. Isomerism in coordination compounds, stereo isomerism -(a) geometrical isomerism in (i) square planar meta l complexes of the type[MA<sub>2</sub>B<sub>2</sub>], [MA<sub>2</sub>BC], [M(AB)<sub>2</sub>], [MABCD]. (ii) Octahedral metal complexes of the type [MA<sub>4</sub>B<sub>2</sub>], [M(AA)<sub>2</sub>B<sub>2</sub>], [MA<sub>3</sub>B<sub>3</sub>] using suitable examples, (b) Optical isomerism in (i). tetrahedral complexes [MABCD], (ii). Octahedral complexes [M(AA)<sub>2</sub>B<sub>2</sub>], [M(AA)<sub>3</sub>] using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

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S3-I-3: Metal carbonyls and Organometallic 5h Chemistry Metal carbonyls: Preparation and properties of Ni(CO)<sub>4</sub>. Structural features of Ni(CO)<sub>4</sub>. Fe(CO)<sub>5</sub>, Fe<sub>2</sub>(CO)<sub>9</sub>, Fe<sub>3</sub>(CO)<sub>12</sub> and Cr(CO)<sub>6</sub> -18 valence electron rule. Definition, nomenclature and classification of organometallic compounds. Methods of preparation, properties and applications of alkyl and aryl compounds of Li, Mg & Al.

## Unit - II (Organic Chemistry)

15h(1 hr/weck)

## S3-O-1: Carboxylic acids and derivatives

5h

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

#### S3-O-2: Nitrohydrocarbons

3 h

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

#### S3-O-3: Amines, Cyanides and Isocyanides

7 h

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

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

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reduction iv) oxidation.

## Unit III (Physical Chemistry)

15 h (1 hr/week)

S3-P-1:Thermodynamics -I

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

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

S3-P-2: Thermodynamics-II

5 h

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

#### Unit – IV (General Chemistry)

15 h (1 hr/week)

S3-G-1 Evaluation of analytical data

4h

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

S3-G-2: Carbanions-I

5h

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

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Statement and meaning of the terms - Phase, Component and Degrees of freedom, Gibb's Phase rule, phase continue of the terms - Phase, Component and Degrees of freedom, Gibb's Phase rule, phase equilibria of one component system - water system. Phase equilibria of twocomponent system Solid Liquid equilibria, simple enteetle Ph-Ag system, desilverisation of lead. Solid solutions compound with congruent melting point. Mg-Zn system and incongruent melting point NaCI-ILO system.

#### References

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Varaprasada Rao, K.L.N. Reddy and C. Sudhakar

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- 3. Concise Inorganic Chemistry by J.D. Lee Jaredn Van Nostrand Reinhold Company(1977)
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- 7. Inorganic Chemistry by Shriver and Atkins Jacob Oxford Press (1999).
- Textbook of Inorganic Chemistry by R Gopalan(Universities Press(2012)
- 9, College Practical chemistry by V.K. Ahluwalia, Sunitha Dhingra and Adarsh Gulati Universities Press (India) Limited(2012)

#### Unit- II

- 1. Text book of organic chemistry by Soni. Sultan Chand & Sons; Twenty Minth edition (2012)
- 2. General Organic chemistry by Sachin Kumar Ghosh, New Age Publishers Pvt Ltd (2008).
- Text book of organic chemistry by Morrison and Boyd. Person(2009)
- Text book of organic chemistry by Graham Solomons, Wiley(2015)
- 5. Text book of organic chemistry by Bruice Yuranis Powla. (2012)
- 6. Text book of organic chemistry by C N pillai CRC Press (2012)
- 7. Organic Chemistry by L. G. Wade Jr.
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- 9. Organic Chemistry by John McMurry.

- 1. Principles of physical chemistry by Prutton and Marron. The MacmillanCompany; 4<sup>th</sup> Edn.(1970)
- 2. Text Book of Physical Chemistry by Soni and Dharmahara, Sulthan Chand and Sons.(2011)
- 3. Text Book of Physical Chemistry by Puri and Sharma, S. Nagin chand and Co.(2017)
- 4. Text Book of Physical Chemistry by K. L. Kapoor. (2012)
- 5. Colloidal and surface chemistry, M. Satake, Y. Hayashi, Y.Mido, S.A.Iqbal and
- 6. M.S.sethi, Discovery Publishing Pvt.Ltd (2014)
- 7. Material science by Kakani & Kakani, New Age International(2016)
- 8. Physical Chemistry by Ira Levine (Author) McGraw-Hill Education; 6 edition (May 9, 2008)

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3. Text book of organic chemistry by Sony, Sultan Chand & Sons; 29th edition (2012)

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5. General Organic chemistry by Sachin kumar Ghosh, New Age Publishers Pvt Ltd (2008)

## **Laboratory Course**

## Paper III (Organic Synthesis)

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 - naphthyl methyl ether.

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Condensation: Preparation of benzilidine aniline and Benzaldehyde and aniline.

Diazotisation: Azocoupling of β-Naphthol.

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

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#### B.Se II yr CHEMISTRY SEMESTER WISE SYLLABUS SEMESTER IV Paper-IV Chemistry - IV

Unit-I (Inorganic Chemistry) S4-I-1: Coordination Compounds -II 15h (1 h/week)

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Crystal field theory (CFT)- Postulates of CFT, splitting patterns of d-orbitals in etahedral, tetrahedral, square planer with suitable examples. Crystalfield stabilization energies and its calculations for various do configurations in octahedral complexes. High Spin Low Spin complexes. Colour and Magnetic properties of transition metal complexes. Calculations of magnetic moments spin only formula. Detection of complex formation - basic principles of various methods- change in chemical properties, solubility, colour, pH, conductivity, magnetic susceptibility.

Hard and soft acids bases (HSAB) - Classification, Pearson's concept of hardness and softness, application of HSAB principles - Stability of compounds / complexes, predicting the feasibility of reaction. Thermodynamic and kinetic stability of transition of metal complexes. Stability of metal complexes -stepwise and overall stability constant and their relationship and chelate effect determination of composition of complex by Job's method and mole ratio method.

Applications of coordination compounds: 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.

#### S4-I-2: Bioinorganic Chemistry

411

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (CI- ). Toxic metal ions As, Hg & Pb Oxygen transport and storage - structure of hemoglobin, binding and transport of oxygen. Fixation of CO2 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).

#### Semester-IV

Unit - II (Organic Chemistry)

S4-O-1: Carbohydrates

15h(1 hr/week)

Introduction: Classification and nomenclature. 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. Number of optically active, isomers possible for the structure, configuration

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of glucose based on D-glyceraldehyde as primary standard (No proof for configuration is required). Evidence for Carbon and required) Evidence for cyclic structure of glucose (Pyranose structure, anomeric Carbon and anomers). Proof for the ring size (methylation, hydrolysis and oxidation reactions). (Haworth formula and chair and place (methylation, hydrolysis and oxidation reactions). formula and chair conformational formula). Structure of fructose: Evidence of 2 - ketohexose structure. Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, eyelic structure for fructose (Furanose structure,Haworth formula).

Inter Conversion of Monosaccharides: : Arabinose to D-glucose, D- mannose (kiliani - Fischer method). Follower to D-glucose, D- mannose (kiliani - Fischer method). method). Epimers, Epimerisation- Lobry de bruyn van Ekenstein rearrangement. D-glucose to D-arabinose by Ruff's degradation. Aldohexose(+) (glucose) to ketohexose (-) (fructose) and Ketohexose(Fruetose) to aldohexose (Glucose).

## S4-O-2: Amino acids and proteins

5 h

Classification. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, Valine and Leucine) by following methods: a) From halogenated Carboxylie acid b)Malonic ester synthesis c) strecker's synthesis. Physical properties: Optical activity of naturally occurring amino acids. Zwitter ion structure salt like character, definition of isoelectric point. Chemical properties: General reactions due to amino and earboxyl groups - Lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides. Primary structure of proteins, di peptide synthesis

#### S4-O-3: Heterocyclic Compounds

4 h

Introduction and definition: 5 membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole. Importance of ring systems -Numbering. Aromatic character

Resonance structures: Explanation of feebly acidic character of pyrrole, electrophillic substitution, Halogenation, Nitration and Sulphonation. Reactivity of furan as 1,3-diene, Diels Alder reactions (one example). Sulphonation of thiophene purification of Benzene obtained from coal (ar). Preparation of furan, Pyrrole and thiophene Paul-Knorr synthesis. Structure of pyridine, Basicity - Aromaticity - Comparison with pyrrole - preparation by Hantsch method and properties - Reactivity towards Nucleophilic substitution reaction - chichibabin reaction.

#### Unit III (Physical Chemistry)

15h (1 hr/week)

#### S4-P-1: Chemical Kinetics

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 a reaction.

First order reaction, derivation of equation for rate constant. Characteristics of first order reaction. Units for rate constant. Half- life period, graph of first order reaction, Examples-Decomposition of H<sub>2</sub>O<sub>2</sub> and decomposition of oxalic acid, Problems.

Pseudo first order reaction, Hydrolysis of methyl acetate, inversion of cane sugar, problems. Second order reaction, derivation of expression for second order rate constant, examples-

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Saponification of ester,  $2O_3 \rightarrow 3O_2$ ,  $C_2H_4+H_2 \rightarrow C_2H_6$ . Characteristics of second order reaction units for rate and  $2O_3 \rightarrow 3O_2$ ,  $C_2H_4+H_2 \rightarrow C_2H_6$ . reaction, units for rate constants, half- life period and second order plots. Problems

S4-P-2: Photochemistry

Introduction to photochemical reactions, Difference between thermal and photochemical reactions I am of reactions. Laws of photo chemistry- Grotthus photochemical equivalence. Quantum yield. Draper law, Stark-Einstein's Law of different quantum yields. Photo chemical combinations of H<sub>2</sub>-Cl<sub>2</sub>and H<sub>2</sub>-Br<sub>2</sub> reactions, reasons for the high and low quantum yield. Problems based on quantum efficiency. Consequences of light absorption. light absorption. Singlet and triplet states. Jablonski diagram. Explanation of internal conversion, inter- system crossing, phosphorescence, fluorescence.

Unit III (General Chemistry) S4-G-1: Theories of bonding in metals

15h (1 hr/week)

4 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 n-type and p-type, extrinsic & intrinsic semiconductors, and insulators.

## S4-G-2: Carbanions-II

5h

Mannich reaction, Michael addition and Knoevengeal condensation Synthetic applications of Aceto acetic ester. Acid hydrolysis and ketonic hydrolysis: Preparation of ketones, monocarboxylic acids and dicarboxylic acids Malonic ester- synthetic applications. Preparation of (i) substituted mono carboxylic acids and (ii) substituted dicarboxylic acids.

S4-G-3: Colloids & Surface Chemistry

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 emulsifier. Liquids in solids(gels): Classification, preparations and properties, General

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

#### References

General reference: B.Sc II Year Chemistry: Semester IV, Telugu Academy publication, Hyd

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- 2. Concise Inorganic Chemistry by J.D. Lee 3rd edn. Van Nostrand ReinholdCompany(1977)
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- 7. Elements of Physical Chemistry by Lewis Glasstone. Macmillan (1966)
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- 5. Text book of organic chemistry by Morrison and Boyd, Person (2009)
- 6. Text book of organic chemistry by Graham solomons, Wiley (2015)
- 7. Fundamentals of organic synthesis and retrosynthetic analysis by Ratna Kumar Kar, CBA,(2014)
- 8. Organic synthesis by Dr. Jagadamba Singh and Dr. L.D.S. Yadav, Pragati Prakashan, 2010
- 7. Stereochemistry of organic compounds by D. Nasipuri, New Academic Science Limited, 2012
- 8. Organic chemistry by Clayden, Greeves, Warren and Wothers, Oxford University Press, 2001
- 9. Fundamentals of Asymmetric Synthesis by G. L. David Krupadanam, Universities, Press 2014

**Laboratory Course** 

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Paper IV-

Qualitative and Speetral Analysis of Organic Compounds: 45hrs (3 h/w) Qualitative analysis: Identification of organic compounds through the functional group analysis, determination of melting points/boiling points, functional group tests and preparation of suitable derivatives of the following: Carboxylic acids, phenols, amines, urea, thiourea, carbohydrates, aldehydes, ketones, amides, nitro hydrocarbons, ester and naphthalene. (Speetral analysis: Determination of structures from combined spectral data-(IR, 5 H-NMR and Mass): Minimum

five problems

## B.Sc. Chemistry II Year Semester-III Skill Enhancement Course-1 (SEC-1) (2 Credits) Rules in Chemistry Laboratory and Lab Rengents

Unit I: Laboratory Safety Rules and Regulations

General rules and regulations for lab safety: Minimizing Risks of Hazards, Personal Protective Equipment (PPE) - Hair, Dressing for the Laboratory, Eye Protection, Eyewash fountain, Gloves, Laboratory Protocols, Labeling Chemicals, Careful reading of labels Prevention of Inhaling Harmful Chemicals, Guide to Chemical Hazards, Chemical Spills etc., Accidents use of fire extinguisher and first aid kit in the laboratory, safety symbols- Preparation of the charts by the students and display of chats in chemistry labs, Calibration of fractional weights, calibration of glass ware - burette, pipette, standard flask, Normality/Molarity and specific gravity of concentrated acids — Preparation of dilute solutions (Numerical problems). Precautions to be taken in the preparation of dilute acids and bases and bases. Preparation of stock solutions of salts with specific examples. Properties of primary standard salt and preparation of standard solution. Good laboratory practices-maintenance of observation book record.

UNIT 2: Preparation of Lab Reagents 15 h (1 hr/week)

Preparation of indicators and use of indicators in volumetric analysis- acid base titrations, redox titrations, precipitation fitrations and complexometric titrations. Role of an indicator in detecting end point (Phenolphthalein, Methyl orange, Methyl-red, Potassium Chromate, Diphenylamine, EBT, Murexide, etc). Preparation of buffers – pH 10 ammonical buffer and acetate buffer solutions. Preparation of commonly used reagents: Ammonium hydroxide solution, Ammonium molybdate reagent, Ammonium hydrogen phosphate solution, Bayer's reagent, Benedict's solution, Bromine water, Dimethyl glyoxime reagent, 2,4-Dinitrophenyl hydrazine reagent, Eriochrome black-T reagent Fehling solution, Ferric chloride solution, Ferrous sulphate solution, Iodine solution, Molisch's reagent, Nessler's reagent, Neutral FeCl3, Schiff's reagent, Silver nitrate solution, Sodium carbonate solution, Sodium hydroxide (Caustic soda) solution, Starch solution, Tollen's reagent. (reference work and submission of assignments). Charts preparation depicting course content.

#### RECOMMENDED BOOKS

1. Vogel's Text Book of Quantitative Chemical Analysis, 5th edition.

2. Vogel's Text Book of macro and semimicro qualitative inorganic analysis. G. Svehla, 5th edition.

3. Chemistry Reagent Manual Prepared by Chemistry Department, SGTB Khalsa College under DBT's Star College Scheme, University of Delhi (Available: online)

4. American Chemical Society Safety in Academic Chemistry Laboratories 8th edition.

[Course objectives (CO)]: To improve the skills of students in the application of theory and practical knowledge. To fill the gap between theory and practicals. To train the students in understanding laboratory safety rules and to improve the skills in preparation of laboratory reagents]

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#### B.Sc. Chemistry II Year Semester III

## Skill Enhancement Course- II (SEC -II (2 Credits) REMEDIAL METHODS FOR POLLUTION, DRINKING WATER AND SOIL FERTILITY STANDARDS

## UNIT 1: Remedial Methods for Pollution Prevention and control of air pollution 15 h (1 hr/week)

Ozone hole-causes and harm due to ozone depletion. The effect of CFC's in Ozone depletion and their replacements. Global Warming and Greenhouse Effect Precautions to control global warming. Deleterious effect of pollutants - Endangered Monuments- acid rain. Precautions to protect monuments. Sources of Radiation pollution - Chernobyl accident and its Consequences. Radiation effect by the usage of cell phones and protection tips. Deleterious effects of cell phone for the control of t

Sources of water pollution-(i). Pollution due to pesticides and inorganic chemicals, (ii). Thermal pollution (iii). Ground water pollution (iv). Eutrophication.

Methods for control of water pollution and water recycling. Dumping of plastics in rivers & oceans and their effect on aquatic life. Determination of (i) Dissolved Oxygen and (ii) Chemical Oxygen Demand in polluted water - Illustration through charts (or) demonstration of experiments. Sources of soil pollution (i). Plastic bags, (ii). Industrial and (iii). Agricultural sources. Control of soil pollution. Environmental laws in India. Environmental benefits of planting trees.

## UNIT II: Drinking Water and Soil Fertility Standards and Analysis 15 h (1 hr/week)

Water Quality and Common Treatments for Private Drinking Water Systems: Drinking Water Standards-Primary Drinking Water Standards: Inorganics, Organics and Volatile Organic Chemicals. Secondary Drinking Water Standards-Inorganics and Physical Problems. Water Testing, Mineral Analysis, Microbiological Tests, Pesticide and Other Organic Chemical Tests. Principle involved in Water Treatment Techniques. (i) Reverse osmosis (ii) Disinfection methods such as chlorination, ultraviolet light, ozonation etc (iii) Chemical oxidation and (iv) Ion exchange (water softeners). Visit to nearby drinking water plants and interaction at sites.

Introduction to Soil Chemistry- Basic Concepts. Effect of pH on nutrient availability. Macronutrients and their effect on plants -Carbon, Hydrogen, Oxygen, Nitrogen and Phosphorus other macronutrients-Calcium, Magnesium and Sulfur. Micronutrients and their effect on plants. Boron (B4 O7 2-), Copper (Cu2+), Iron (Fe2+, Fe3+) Manganese (Mn2+) Molybdenum (MoO4 2-) Zinc (Zn2+) Cobalt (Co2+) Chlorine (Cl-) and Others. Determination of soil nitrogen by Kjeldahl method- Illustration through charts (Or) demonstration of experiment. Visit to nearby agricultural forms and interaction with farmers. Discussion with farmers on the use of Soil Analysis Kits.

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#### References

1. A Text book for 'Remedial methods for pollution, drinking water and soil fertility standards', First Edition, Authors: Dr Mudvath Ravi, Gopu Srinivas, Putta Venkat Reddy, Vuradi Ravi Kumar, Battini Ushaiah, ISBN No. 978-93-5311-183-0.

2. Remedial methods for pollution, drinking water and soil fertility standards, Author: Dr G.

Vanjatha.

3. Remedial methods for pollution, drinking water and soil fertility standards, Telugu version, Authors: Dr N. Yogi Babu, Dr. G. Vanajatha, M. Srilatha.

4. Environmental Pollution, download.nos.org/333courseE/10.pdf

5. CFC Replacements, butane.chem.uiuc.edu/pshapley/Environmental/L21/3.html

6. Effects of Acid Rain on Buildings www.air-quality.org.uk/12.php

7. Acid Rain Effects - Buildings - Chemistry

chemistry.elmhurst.edu/vchembook/196buildings.html 8. How to protect national heritage - ways to protect monuments www.youthkiawaaz.com/2011/03/how-to-protect-national-heritage/.

9. Chernobyl nuclear power plant accident - NRC www.nrc.gov/reading-rm/doc-

collections/fact-sheets/chernobyl-bg.pdf

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12. Chemical Waste That Impact on Aquatic Life or Water Quality

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17. Determination of dissolved oxygen (DO)

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# B.Sc. Chemistry II Year Semester - IV Skill Enhancement Course- III (SEC - III) (2 Credits) Materials and their Applications

## Unit - I: Types of Materials

15 h (1 hr/week)

Introduction: Materials and their importance. Classification of Materials, Advanced materials and their need. Types of Materials: Metals, ceramics, polymers and composites; Nature of bonding (Type of bond present). Types and applications of metal alloys: Classification- ferrous and non-ferrous alloys. Ferrous alloys -types and their applications. Non-ferrous alloys - Cu, Al, Ti alloys, their applications and super alloys.

Field Work- Collection of Metal Alloy Samples.

Types and Applications of Ceramics: Classification of Ceramics based on their application- glasses, clay products, refractories, abrasives, cements, and advanced ceramics. Glasses: Compositions and Characteristics of Some of the Common Commercial Glasses; Properties and applications of glass ceramics - preparation of charts depicting various types of glass and their use. Clay products: Structural clay products and the white wares. Refractories: Compositions of four Common Ceramic Refractory Materials, fireclay, silica, basic refractories ex. MgO and special refractories ex. Alumina and Zirconia Cements: Classification, preparation of cement and the setting process; quick setting cements; applications.

Field Work-Visit to industries and collection of samples of materials

## Unit - II: Types of Polymers and Applications

15 h (1 hr/week)

Classification of Polymeric materials based on application: Coatings, adhesives, films, foams with examples Polymer Additives: Fillers, Plasticizers, Stabilizers, Colorants, Flame Retardants with examples.

Advanced Materials: Types of advanced materials - semiconductors, bio-compatible materials, smart materials, advanced polymeric materials and nano-engineered materials. Biocompatible materials: Definition. Materials used as biomaterials and their properties. Metals and alloys used in bone and joint replacement. Filling and restoration materials - dental cements, dental amalgams, dental adhesives.

Field Work- Visit to Dental Clinics and interaction with Doctors regarding materials used in Dental treatments.

Smart materials: Shape memory alloys- definition and examples (Ni-Ti alloys, Cu based alloys), applications. Conducting polymers: - Introduction, Electrically conducting polymers and their uses (polyaniline, polypyrrole, polyacetylene and polythiophene).

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#### B.Sc. Chemistry II Year Semester IV Skill Enhancement Course- IV (SEC - IV) (2 Credits) Chemistry of Cosmetics and Food Processing

## Unit-1: Chemistry of Cosmetics and Perfumes

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, sunscreen lotions, lipsticks, taleum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Essential oils and their importance in cosmetic industries with reference to eugenol, geraniol, sandalwood oil, eucalyptus, 2-phenyl ethyl alcohol. Demonstration experiments or illustration of experimental procedures through charts for the preparation of talcum powder, shampoo and vanishing cream, Analysis of deodorants and antiperspirant - Aluminum, Zinc, Boric acid, Chloride and Sulphide.

## Unit-II: Food Processing and Food Adulteration

Food processing: Introduction, methods for food processing, additives and preservatives. Food processing- impact on nutrition, analysis of calcium in milk by complexometric titration, spectrophotometric analysis of iron in foods, Spectrophotometric identification and determination of caffeine and benzoic acid in soft drinks. Field Work -Visit to Food Industries. Food adulteration: Adulterants in some common food items and their identification: Pulses, chilli powder, turmeric powder, milk, honey, spices, food grains and wheat flour, coffee powder, tea leaves, vegetable oil, ghee, ice creams, tomato sauce. Field Work-Collection of adulterated food samples, demonstration of a minimum of five experiments for testing adulterants in food items.

#### References

- 1. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK.
- 2. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi
- 3. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).
- 4. Rameen Devi, Food Processing and Impact on Nutrition, Sc J Agric Vet Sci., AugSep 2015; 2(4A):304-311.
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- 9. Fundamental concepts of applied chemistry J.C Ghosh, S. Chand and Co, Ltd, New Delhi.
- 10. Applied Chemistry K. Bhagavathi Sundhar, MJP publishers.

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#### **B.Sc. CBCS CHEMISTRY**

#### Theory Model Question Paper For

DSC & DSE Time: 3 hrs Max. Marks: 80 Part-A (Short Answer Questions) I. Write any Eight questions of the following 8 X 4 = 32M1. 2. 3. 4. 5. 6. 7. 8. 9. 10 11 12 Part-B (Essay Answer Questions) II. Answer All the questions 4 X12 = 48M1. a. (OR) b. 2. a. (OR) b. 3. a. (OR) b. 4. a. (OR) b. practicals 50 March