

**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 2021-2022**

FIRST YEAR- SEMESTER I

Department of Chemistry
University College for Women
Koti, Hyderabad-505 005.

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

FIRST YEAR- SEMSTER II

BS 201	Ability Enhancement Compulsory Course AECC-2	BCS	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I	DSC-1B	4T+3P=7	4+1=5
BS 205	Optional II	DSC-2B	4T+3P=7	4+1=5
BS 206	Optional III- Chemistry - II	DSC-3B	4T	4
	Laboratory Course - II (Quantitative Analysis - Titrations)		3P	1
Total Credits			31	25

SECOND YEAR- SEMSTER III

BS 301	i) Safety Rules in Chemistry Laboratory and Lab Reagents ii) Remedial methods for pollution, drinking water and Soil fertility	SEC-1 SEC-2	2 2	2 2
BS 302	English	CC-1C	3	3
BS 303	Second language	CC-2C	3	3
BS 304	Optional I	DSC-1C	4T+3P=7	4+1=5
BS 305	Optional II	DSC-2C	4T+3P=7	4+1=5
BS 306	Optional III- Chemistry - III	DSC-3C	4T	4
	Laboratory Course - III (Synthesis of Organic compounds)		3P	1
Total Credits			31	25

SECOND YEAR- SEMSTER IV

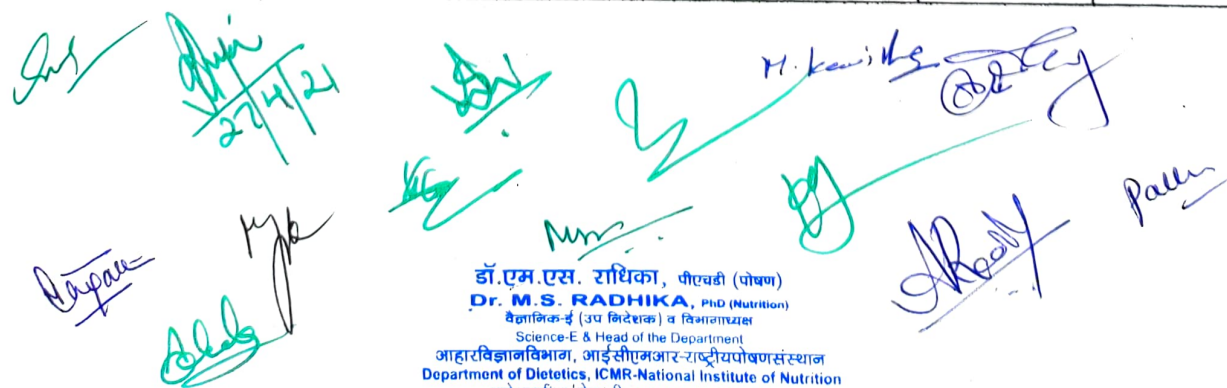
BS 401	i) Materials and their Applications ii) Chemistry of Cosmetics and Food Processing	SEC-3 SEC-4	2 2	2 2
BS 402	English	CC-1D	3	3
BS 403	Second language	CC-2D	3	3
BS 404	Optional I	DSC-1D	4T+3P=7	4+1=5
BS 405	Optional II	DSC-2D	4T+3P=7	4+1=5
BS 406	Optional III- Chemistry - IV	DSC-3D	4T	4
	Laboratory Course - IV (Qualitative Analysis of Organic Compounds)		3P	1
Total Credits			31	25

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

B. Sc. Chemistry, III year, CBCS Syllabus
Telangana State Council of Higher Education, Govt. of Telangana, B.Sc. CBCS
Common Core Syllabus for all Universities in Telangana
 B. Sc. Chemistry (For the batch admitted in 2019-2020)

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

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



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

(For the batch admitted in 2021-2022) onwards

Paper - II
Chemistry - II

Unit-I (Inorganic Chemistry)

15 h (1hr/week)

S2-I-1: p-block Elements-II

7h

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 (HNO_2 , HNO_3 , $\text{H}_2\text{N}_2\text{O}_2$, HNO_4) P (H_3PO_2 , H_3PO_3) S (H_2SO_3 , H_2SO_4 , $\text{H}_2\text{S}_2\text{O}_3$, H_2SO_5 , $\text{H}_2\text{S}_2\text{O}_8$) P, S, Cl and I. Redox properties of oxyacids of Nitrogen: HNO_2 (reaction with FeSO_4 , KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$), HNO_3 (reaction with H_2S , Cu), HNO_4 (reaction with KBr, Aniline), $\text{H}_2\text{N}_2\text{O}_2$ (reaction with KMnO_4). Redox properties of oxyacids of Phosphorus: H_3PO_2 (reaction with HgCl_2), H_3PO_3 (reaction with AgNO_3 , CuSO_4) Redox properties of oxyacids of Sulphur: H_2SO_3 , H_2SO_4 (reaction with KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$), H_2SO_4 (reaction with Zn, Fe, Cu), $\text{H}_2\text{S}_2\text{O}_3$ (reaction with Cu, Au), H_2SO_5 (reaction with KI, FeSO_4), $\text{H}_2\text{S}_2\text{O}_8$ (reaction with FeSO_4 , KI). Redox properties of oxyacids of Chlorine.

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

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

Pseudohalogens: Comparison with halogens.

S2-I-2: Chemistry of Zero group elements

2 h

Isolation of noble gases (chemico - physical method), Structure, bonding and reactivity of Xenon compounds - Oxides, Halides and Oxy-halides. Clathrate 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 atomic and ionic radii, metallic character, formation of alloys, electronic configuration, variable valence, ability to form complexes, magnetic properties & catalytic properties. Stability of various oxidation states. Comparative treatment of second and third transition series with their 3d analogues. Study of Ti, Cr and Cu triads. Titanium triad - electronic configuration and reactivity of +3 and +4 states- oxides and halides. Chromium triad - reactivity of +3 and +6 states. Copper triad - reactivity of +1, +2 and +3 states.

Unit – II (Organic Chemistry)

15h (1 hr/week)

S2-O-1: Halogen compounds

4 h

Nomenclature, 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-phenyl propane, 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: Nomenclature, Preparation: 1° , 2° and 3° alcohols using Grignard 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: Nomenclature, 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-Baumann reaction, Houben-Hoesch condensation.

Ethers: Nomenclature, preparation by (a) Williamson's synthesis (b) from alkenes by the action of Conc. H_2SO_4 . Physical properties – solubility - Absence of Hydrogen bonding, insoluble in water, low boiling point. Chemical properties – inert nature, action of Conc. H_2SO_4 and HI.

S2-O-3: Carbonyl compounds

5h

Nomenclature, 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_3 (mechanism) (b) HCN (c) NH_3 (d) RNH_2 (e) NH_2OH (f) PhNHNH_2 (g) 2,4-DNP (Schiff bases). Addition of H_2O to form hydrate, chloral hydrate (stable), addition of alcohols - hemiacetal and acetal formation. Cannizzaro reaction (mechanism). Oxidation reactions – KMnO_4 oxidation and auto-oxidation, mechanism of Clemmenson's reduction, Wolf-Kishner reduction, Meerwein Ponndorf Verley reduction.

8

1,2-dichloro cyclopropane). Molecules with constitutionally symmetrical chiral carbons (Tartaric acid) Molecules with constitutionally unsymmetrical chiral carbons (2,3-dibromopentane). D, L configuration – examples. R, S – configuration: Cahn-Ingold-Prelog rules, examples for asymmetric and disymmetric molecules.

S2-G-3: Dilute Solutions & Colligative Properties

4h

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.

References

General Reference: B.Sc. I Year Chemistry : Semester II, 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 Edition.
3. Basic Inorganic Chemistry by F.A. Cotton, G. Wilkinson and Paul L. Gaus 3rd Edition. Wiley Publishers 2001.
4. Chemistry of the elements by N.N. Greenwood and A. Earnshaw Pergamon Press 1989.
5. Inorganic Chemistry by Shriver and Atkins 3rd Edition. Oxford Press 1999.
6. Inorganic Chemistry Principles of structure and reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter 4th Edition.
7. Textbook of inorganic chemistry by R Gopalan.

Unit II

1. Organic Chemistry by Morrison and Boyd.
2. Organic Chemistry by Graham Solomons.
3. Organic Chemistry by Bruce 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.
10. Organic Chemistry by Jain & Sharma.

Unit III

1. Physical chemistry by P W Atkins
2. Principles of physical chemistry by Prutton and Marron.
3. Text Book of Physical Chemistry by Soni and Dharmahara.
4. Text Book of Physical Chemistry by Puri and Sharma

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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.

Unit IV

1. Vogel's Text Book of Quantitative Analysis by G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney 5th Edition. Addison Wesley Longman Inc. 1999.
2. Quantitative Analysis by Day and Underwood Prentice Hall (India) 6th Edition.
3. Stereochemistry by Nasipuri
4. Stereochemistry by P. S. Kalsi
5. Physical chemistry by P W Atkins
6. Principles of physical chemistry by Prutton and Marron.
7. Text Book of Physical Chemistry by Soni and Dharmahara.
8. Text Book of Physical Chemistry by Puri and Sharma

Laboratory Course

45hrs (3 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.

Complexometric Titrations

1. Estimation of Mg^{2+}
2. Estimation of Cu^{2+}

References:

1. Lab manual for UG students prepared by Department of Chemistry, University College for Women, Koti, Hyd.
2. Vogel's Quantitative Inorganic Analysis by Svehla.

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glucose based on D-glyceraldehyde as primary standard (No proof for configuration is 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 conformational formula). Structure of fructose: Evidence of 2 - ketohexose structure. Same osazone formation from glucose and fructose, Hydrogen bonding in osazones, cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: : Arabinose to D-glucose, D- mannose (Kiliani - Fischer 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 (Fructose) 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 Carboxylic 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 carboxyl groups - Lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides. Primary structure of proteins, dipeptide synthesis

S4-O-3: Heterocyclic Compounds

4h

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, electrophilic 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 tar). 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 (1hr/week)

S4-P-1: Chemical Kinetics

11 h

Introduction to chemical kinetics, rate of reaction, variation of concentration with time, rate laws and rate constant. 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_2O_2 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 constants, half-life period and second order plots. Problems
 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 (only brief discussion). Effect of temperature on reaction rate, Arrhenius equation. Temperature coefficient. 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).

S4-P-2: Photochemistry

4 h

Introduction to photochemical reactions, Difference between thermal and photochemical reactions, Laws of photo chemistry- Grotthus Draper law, Stark-Einstein's Law of photochemical 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 absorption. Singlet and triplet states. Jablonski diagram. Explanation of internal conversion, inter- system crossing, phosphorescence, fluorescence.

Unit IV (General Chemistry)

15h (1hr/week)

S4-G-1: Theories of bonding in metals

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

5 h

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

6 h

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 applications of colloids.

Adsorption: Types of adsorption. Factors influencing adsorption. Freundlich adsorption

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isotherm. Langmuir theory of unilayer adsorption isotherm. Applications.

References

General reference: B.Sc II Year Chemistry : Semester IV, 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 Edition. Van Nostrand Reinhold Company (1977)
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd Edition, Wiley Publishers (2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th Edition. (2006)
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7. Textbook of Inorganic Chemistry by R Gopalan, Universities Press, (2012).

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2. General Organic Chemistry by Sachin Kumar Ghosh. New Age Publishers Pvt Ltd (2008)
3. Text book of Organic Chemistry by Morrison and Boyd. Pearson Publications (2009)
4. Text book of Organic Chemistry by Graham Solomons. Wiley Publications (2015)
5. Text book of Organic Chemistry by Bruce Yuranis Powla. (2012)
6. Text book of Organic Chemistry by C N pillai, CRC Press (2012)
8. Organic Chemistry by L. G. Wade Jr.
9. Organic Chemistry by M. Jones Jr.
10. Organic Chemistry by John McMurry.

Unit III

1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th Edition. (1970)
2. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand & Sons.(2011)
3. Text Book of Physical Chemistry by Puri and Sharma. (2017)
4. Text Book of Physical Chemistry by K. L. Kapoor.(2012)
5. Physical Chemistry through problems by S.K. Dogra.(2015)
6. Text Book of Physical Chemistry by R.P.Verma.
7. Elements of Physical Chemistry by Lewis Glasstone. Macmillan(1966)
8. Industrial Electrochemistry, D. Pletcher, Chapman & Hall, London,1990.

Unit IV

1. Principles of Inorganic Chemistry by Puri, Sharma and Kalia, Vishal Publications (1996).
2. Concise Inorganic Chemistry by J. D. Lee 3rd Edition, Van Nostrand Reinhold Company (1977)
3. Basic Inorganic Chemistry by F.A.Cotton, G.Wilkinson and Paul.L. Gaus 3rd Edition, Wiley Publishers (2001).
4. Inorganic Chemistry Principles of structure and reactivity by James E.Huhey, E.A. Keiter and R.L. Keiter 4th edn. (2006).
5. Text book of Organic Chemistry by Morrison and Boyd, Pearson Publications (2009).

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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 (1hr/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 (1hr/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).

References

1. William D. Callister, Materials Science and Engineering An Introduction, John Wiley & Sons, Inc, 2006.
2. Material science by Kakani and Kakani.
3. Sujata V., Bhat., —BiomaterialsI, Narosa Publication House, New Delhi, 2002.
4. M. V. Gandhi and B. S. Thompson, —Smart Materials and StructuresI, Chapman and Hall, London, First Edition, 1992.
5. Duerig, T. W., Melton, K. N, Stockel, D. and Wayman, C.M., —Engineering aspects of Shape memory Alloys, Butterworth – Heinemann, 1990.
6. Conducting Polymers, Fundamentals and Applications A Practical Approach Authors: Chandrasekhar, Prasanna Ashwin-Ushas Corp., Inc. Kluwer Academic Publishers. Boston

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B.Sc. Chemistry III Year
Semester –VI, BS 601
Optional for Chemistry Stream
Advanced Chemistry - V

60Hrs

Unit-I (Inorganic Chemistry)

15 Hrs

S6-O-I-1: Inorganic Reaction Mechanisms

4h

Labile and inert complexes, Thermodynamic and kinetic stability, ligand substitution reactions – S_N^1 and S_N^2 in Octahedral complexes; substitution reactions of square planar complexes – Trans effect and applications of trans effect. Reactions of tetrahedral complexes - Hydrolysis of silicon halides ($SiCl_4$) and phosphorous oxides (P_2O_5).

S6-O-I-2: Boranes and Carboranes:

2 h

Definition of clusters. Structures of boranes and carboranes- Wade's rules, Closo ($B_6H_6^{2-}$), Nido (B_5H_9), Arachno Boranes (B_4H_{10}) and Carboranes ($C_2B_{10}H_{12}$).

S6-O-I-3: Symmetry of molecules

5 h

Introduction, Symmetry operations and symmetry elements in molecules. Definition of Axis of symmetry types of C_n , Plane of symmetry (σ_h , σ_v , σ_d), Centre of symmetry and Improper or Rotation-reflection axis of symmetry (S_n). Explanation with examples.

S6-O-I-4: Non – aqueous solvents

4 h

Classification and characteristics of a solvent. Reactions in liquid ammonia – physical properties, auto-ionisation, examples of ammono acids and ammono bases. Reactions in liquid ammonia – precipitation, neutralization, solvolysis, solvation - solutions of metals in ammonia, complex formation, redox reactions. Reactions in HF – auto-ionisation, reactions in HF – precipitation, acid – base reactions, protonation.

Unit-II (Organic Chemistry)

15 Hrs

S6-O-O-1: Pericyclic Reactions

5 h

Concerted reactions, Molecular orbitals of ethene, 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.

S6-O-O-2: Synthetic Strategies

5 h

Terminology – Target molecule (TM), Disconnection approach – Retrosynthesis, Symbol, Synthons, Synthetic equivalent (SE), Functional group interconversion (FGI), Linear and Convergent synthesis. Retrosynthetic analysis of the following molecules: 1) acetophenone 2) cyclohexene and 3) 2-phenylethanol.

S6-O-O-3: Asymmetric synthesis

5 h

Definition and classification of stereoselective reactions: substrate, product stereoselective reactions, enantio and diastereo selective reactions. Stereospecific reaction – definition – example – dehalogenation of 1,2-dibromides induced by iodide ion. Enantioselective reactions – definition – example – Reduction of Ethylacetoacetate by Yeast. Diastereoselective reaction- definition-

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example: Acid catalysed dehydration of 1-phenylpropanal and Grignard addition to 2-phenylpropanal. Definition and explanation of enantiomeric excess and diastereomeric excess.

Unit III (Physical Chemistry)

15 Hrs

S6-O-P--1: Polymers

15 h

Definition of polymers – natural polymers and synthetic polymers examples classification as plastics, fibers, elastomers.

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. Tacticity, atacticity, stereo specific synthesis- Zeigler- Natta catalyst.

Molecular weight definitions - number average and weight average molecular weight, Problems.

Determination of molecular weight of polymers using viscosity method, Osmometric method.

Preparation and industrial applications of polyethylene, poly vinyl chloride (PVC), nylon -66, teflon, polyacrylonitrile and terelene.

Introduction to biodegradability and examples of biodegradable polymers.

Unit IV: (General Chemistry)

15 Hrs

S6-O-G--1: Electroanalytical Methods

15 h

Types of Electroanalytical Methods.

I) Interfacial methods – a) Potentiometry: Principle, Electrochemical cell, Electrodes- (i) Indicator and (ii) Reference electrodes – Normal Hydrogen Electrode, Quinhydrone Electrode, Saturated Calomel Electrode. Numerical Problems. Application of Potentiometry – Assay of Sulphanilamide

b) Voltammetry – three electrode assembly; Introduction to types of voltametric techniques, micro electrodes, Over potential and Polarization.

II) Bulk methods – Conductometry, Conductivity Cell, Specific Conductivity, Equivalent Conductivity. Numerical Problems. Applications of conductometry. Estimation of Cl – using AgNO_3 . Determination of Aspirin with KOH.

Recommended Text Books and Reference books:

Unit I

1. Concise Inorganic Chemistry by J. D. Lee, Third Edition, Van Nostrand Reinhold Company(1977)
2. Basic Inorganic Chemistry by F. A. Cotton, G. Wilkinson and Paul L. Gaus, Third Edition, Wiley Publishers (2001).
3. Inorganic Chemistry Principles of Structure and Reactivity by James E. Huhey, E.A. Keiter and R.L. Keiter, Fourth Edition, (2006)
4. Chemistry of the Elements by N. N. Greenwood and A. Earnshaw Pergamon Press (1989).
5. Inorganic Chemistry by Shriver and Atkins, Third Edition, Oxford Press (1999).

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6. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
7. Group Theory and Spectroscopy by F. A. Cotton.
8. Textbook of Inorganic Chemistry by R Gopalan, Universities Press, (2012).

Unit II

1. Text book of Organic Chemistry by Morrison and Boyd, Person(2009)
2. Text book of Organic Chemistry by Graham solomons, Wiley(2015)
3. Fundamentals of Organic Synthesis and Retrosynthetic analysis by Ratna Kumar Kar, NCBA,(2014)
4. Organic Synthesis by Dr. Jagadamba Singh and Dr. L. D. S. Yadav, Pragati Prakashan, 2010
5. Stereochemistry of Organic Compounds by D. Nasipuri, New Academic Science Limited, 2012
6. Organic Chemistry by Clayden, Greeves, Warren and Wothers, Oxford University Press, 2001.
7. Fundamentals of Asymmetric Synthesis by G. L. David Krupadanam, Universities Press(2014)

Unit III

1. A Text book on 'Materials and their Applications', First Edition, Authors: Dr Mudvath Ravi,
2. Gopu Srinivas, Putta Venkat Reddy, Vuradi Ravi Kumar, Battini Ushaiah.
3. Materials Science and Engineering An Introduction by William D. Callister, Jr. John Wiley & Sons, Inc.
4. Material Science by Kakani and Kakani New Age International Pvt Ltd, 2004
5. Sujata V., Bhat., —Biomaterials, Narosa Publication House, New Delhi, 2002
6. M. V. Gandhi and B. S. Thompson, —Smart Materials and Structures, Chapman and Hall, London, First Edition, 1992.
7. Duerig, T. W., Melton, K. N, Stockel, D. and Wayman, C.M., —Engineering aspects of Shape-memory Alloys||, Butterworth – Heinemann, 1990.
8. Chandrasekhar, Prasanna Ashwin-Ushas Conducting Polymers, Fundamentals and Applications - A Practical Approach Authors: Corp., Inc. Kluwer Academic Publishers. Boston.

Unit IV

1. D. A. Skoog, F. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, Engage earning India Ed.
2. D. A. Skoog, D. M. West, F. J. Holler, Fundamentals of Analytical Chemistry, Sixth Edition, Saunders College Publishing, Fort worth (1992).
3. Willard, H. H., Merritt, L. L., Dean, J. & Settoe, F. A. Instrumental Methods of Analysis. 7th Edition. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman. 2007.
5. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
6. Analytical Chemistry 7th Edition by Gary D. Christian (2004).

Multiple handwritten signatures and dates are present at the bottom of the page. Some are in blue ink, others in green. One signature includes the date "27/4/21". Other signatures are partially legible, including "M. Kavitha" and "Ravi".

Unit- IV: Molecular Messengers and Health Promoting Drugs

15Hrs

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

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

Recommended Text Books and Reference books

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, New York. 2013.
2. Thomas Nogrady, Medicinal Chemistry, Oxford Univ. Press, New York.2005.
3. David William and Thomas Lemke, Foye's Principles of Medicinal Chemistry, Lippincott Williams & Wilkins, 2008.
4. Ashutosh Kar Medicinal Chemistry, New Age International, 2005.
5. O. D. Tyagi & M. Yadav Synthetic Drugs by, Anmol Publications,1998.
6. Medicinal Chemistry by Alka L. Gupta, Pragati Prakashan.
7. G. L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K. L. N. Reddy, C. Sudhakar, Drugs, Universities Press (India) Ltd. 2012.

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Jamar-Osmania (PO), Secunderabad 500 007, INDIA

H. K. Singh

Pallavi

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Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene and their uses.

Lubricants: Classification of lubricants, Properties and functions of lubricants (viscosity index, cloud point, pour point) and their determination. Lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants.

Recommended Text Books and Reference books

1. N. N. Melnikov, Chemistry of pesticides; Springer-Verlag- Technology & Engineering (2012).
2. Thomas A. Unger Pesticide Synthesis Handbook; Elsevier, (2000).
3. R. Cremllyn Pesticides; John Wiley, 1980.
4. K. Kolay Manures and Fertilisers; Published by Atlantic (2007).
5. Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
6. Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
7. Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).

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27/4/21

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M. K...

Pallu

B.Sc. CBCS CHEMISTRY
Theory Model Question Paper
For
Semester I, II, III, IV

Time :3Hrs.

Max. Marks : 80

Note: Answer eight questions from Part-A and all questions from Part-B. Each question carries 4 marks in Part-A and 12 marks in Part-B.

Part-A

(8 x 4 = 32 Marks)

(Short Answer Type)

I. Write any Eight questions of the following

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

Part-B

(4 x 12 = 48 Marks)

(Essay Answer Type)

II. Answer all Questions

1 a)

(OR)

b)

2 a)

(OR)

b)

3 a)

(OR)

b)

4 a)

(OR)

b)

Ans
M. Karim
27/4/21

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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 2021-2022

Department of Chemistry
University College for Women
Koti, Hyderabad-505
Head

FIRST YEAR- SEMESTER I

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

FIRST YEAR- SEMSTER II

BS 201	Ability Enhancement Compulsory Course AECC-2	BCS	2	2
BS 202	English	CC-1B	4	4
BS 203	Second language	CC-2B	4	4
BS 204	Optional I	DSC-1B	4T+3P=7	4+1=5
BS 205	Optional II	DSC-2B	4T+3P=7	4+1=5
BS 206	Optional III- Chemistry - II	DSC-3B	4T	4
	Laboratory Course - II (Quantitative Analysis - Titrations)		= 7	=5
			3P	1
	Total Credits		31	25

SECOND YEAR- SEMSTER III

BS 301	i) Safety Rules in Chemistry Laboratory and Lab Reagents ii) Remedial methods for pollution, drinking water and Soil fertility	SEC-1 SEC-2	2 2	2 2
BS 302	English	CC-1C	3	3
BS 303	Second language	CC-2C	3	3
BS 304	Optional I	DSC-1C	4T+3P=7	4+1=5
BS 305	Optional II	DSC-2C	4T+3P=7	4+1=5
BS 306	Optional III- Chemistry - III	DSC-3C	4T	4
	Laboratory Course - III (Synthesis of Organic compounds)		= 7	=5
			3P	1
	Total Credits		31	25

SECOND YEAR- SEMSTER IV

BS 401	i) Materials and their Applications ii) Chemistry of Cosmetics and Food Processing	SEC-3 SEC-4	2 2	2 2
BS 402	English	CC-1D	3	3
BS 403	Second language	CC-2D	3	3
BS 404	Optional I	DSC-1D	4T+3P=7	4+1=5
BS 405	Optional II	DSC-2D	4T+3P=7	4+1=5
BS 406	Optional III- Chemistry - IV	DSC-3D	4T	4
	Laboratory Course - IV (Qualitative Analysis of Organic Compounds)		= 7	= 5
			3P	1
	Total Credits		31	25

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

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

(For the batch admitted in 2021-2022) onwards

Paper - I
Chemistry - I

Unit-I (Inorganic Chemistry)

15 h (1hr/week)

S1-I-1: Chemical Bonding

8 h

Ionic solids - lattice and solvation energy, solubility of ionic solids, Fajan's rule, polarity and polarizability of ions. VSPER Theory - Common hybridization-sp, sp^2 , sp^3 , sp^3d , sp^3d^2 and sp^3d^3 , shapes of molecules. Molecular orbital theory: Shapes and sign convention of atomic overlapping. σ and π orbitals. Modes of bonds. Criteria for orbital overlap. LCAO concept. Concept of Types of molecular orbitals - bonding, anti-bonding and non-bonding. MOED of homonuclear diatomics - H_2 , N_2 , O_2^- , O_2^{2-} , F_2 (unhybridized diagrams only) and heteronuclear diatomics CO , CN^- , NO , NO^+ and HF . Bond order, stability and magnetic properties.

S1-I-2: p-block elements - I

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_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 hr/week)

S1-O-1: Structural Theory in Organic Chemistry

5 h

Bond polarization: Factors influencing the polarization of covalent bonds, Electronegativity - 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. Hyper conjugation and its application to stability of carbonium ions, free radicals and alkenes.

S1-O-2: Acyclic Hydrocarbons

6 h

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

Alkenes - Nomenclature, 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

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- $Shalga$
- $Shalga$
- $M.S.N.$
- $Ravi$

presence of peroxide (anti-Markonikov's addition), Oxidation (cis-additions)-hydroxylation by KMnO_4 , OsO_4 , anti addition- 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 Diels – Alder reaction.

Alkynes– Preparation by dehydrohalogenation of vicinal dihalides, 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), polymerization of acetylene.

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

3h

Black body radiation, Planck's radiation law, photoelectric effect, Limitations of classical mechanics, Compton effect, de Broglie's hypothesis. Heisenberg's uncertainty principle. Schrodinger's wave equation and its importance. Physical interpretation of the wave function, significance of ψ and ψ^2 .

S1-P-2: Gaseous State

5h

Deviation of real gases from ideal behavior. Vander Waals equation of state. Critical phenomenon. PV isotherms of real gases, continuity of state. Andrew's isotherms of CO_2 . The Vander Waal's equation and critical state. Derivation of relationship between critical constants and Vander Waal's 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 and Solutions

Liquid State

4h

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 into Smectic and Nematic, Application of liquid crystals.

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Jama-Osmania (PO), Secunderabad-500 007 INDIA

Solutions

3 h

Liquid - liquid mixtures, ideal liquid mixtures, Raoult's and Henry's laws. Non ideal systems.

Azeotropes: HCl-H₂O and C₂H₅OH - H₂O 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

6h

Anion analysis: Theory of sodium carbonate extract, classification and reactions of anions- CO_3^{2-} , Cl^- , 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 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. Hydrolysis concept for the precipitation of Group V cations. General discussion for the separation and identification of group V individual cations (Ba^{2+} , Sr^{2+} , Ca^{2+}) with flow chart and chemical equations. Theory of flame test. Identification of Group VI cations (Mg^{2+} , NH_4^+)

S1-G-2: Isomerism

5 h

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

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

S1-G-3: Solid State Chemistry

4h

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).

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4

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References

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

Unit- I

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

Unit- II

1. Organic Chemistry by Morrison and Boyd.
2. Organic Chemistry by Graham Solomons.
3. Organic Chemistry by Bruce 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 by Lewis 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 Bruce 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.

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Morrison

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Jamai-Osmania (PO), Secunderabad 500 007 INDIA

Unit – II (Organic Chemistry)

15h (1hr/week)

S3-O-1: Carboxylic acids and derivatives

5h

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

S3-O-2: Nitrohydrocarbons

3h

Introduction, Nomenclature and classification of Nitro hydrocarbons, Structure, Tautomerism of Nitroalkanes leading to aci and keto forms, Preparation of Nitroalkanes. Reactivity - halogenation, reaction with HNO_2 (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

Introduction, Nomenclature, Amines: classification into 1° , 2° , 3° Amines and Quarternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffman's bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Use of amine salts as phase transfer catalysts. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1° , 2° , 3° (Aliphatic and aromatic amines). Electrophilic substitutions of Aromatic amines – Bromination and Nitration, oxidation of aryl and 3° Amines, 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, NO_2 , H and aryl groups. Coupling Reaction of diazonium salts. i) with phenols ii) with anilines. Reduction to phenyl hydrazines.

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

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Unit III (Physical Chemistry)

15 h (1hr/week)

S3-P-1: Thermodynamics-I

10 h

Introduction to Thermodynamics- First law of thermodynamics statement- various forms mathematical expression. Zeroth law of thermodynamics - 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 $C_p - C_v = R$. 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, $PV^\gamma = \text{constant}$. P-V curves for isothermal and adiabatic processes. Heat of a reaction at constant volume and at constant pressure, relation between ΔH and ΔV . Variation of heat of reaction with temperature. Kirchhoff's equation and problems. Limitations of first law and need for second law. Statement of second law of thermodynamics. Cyclic process. Carnot's theorem, Carnot's cycle. Derivation of efficiency of heat engine. Problems.

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

Unit - IV (General Chemistry)

15 h (1hr/week)

S3-G-1: Evaluation of Analytical Data

4 h

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

S3-G-2: Carbanions-I

5 h

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

14

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S3-G-3: Phase Rule

6 h

Statement and meaning of the terms – Phase, Component and Degrees of freedom, Gibb's Phase rule, phase equilibria of one component system – water system. Phase equilibria of two-component system – Solid-Liquid equilibria, simple eutectic – Pb-Ag system, desilverisation of lead. Solid solutions – compound with congruent melting point – Mg-Zn system and incongruent melting point – NaCl-H₂O system.

References

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

Unit- I

1. Analytical chemistry by G. L. David Krupadanam, D. Vijaya Prasad, K. Varaprasada Rao, K.L.N. Reddy and C. Sudhakar
2. Principles of Inorganic Chemistry by Puri, Sharma and Kalia Vishal Publications (1996).
3. Concise Inorganic Chemistry by J.D. Lee 3rd Edition Van Nostrand Reinhold Company (1977)
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 Edition (2006).
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. 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 Ninth edition (2012).
2. General Organic chemistry by Sachin Kumar Ghosh. New Age Publishers Pvt Ltd (2008).
3. Text book of organic chemistry by Morrison and Boyd. Pearson Publications (2009).
4. Text book of organic chemistry by Graham Solomons. Wiley Publications (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.
8. Organic Chemistry by M. Jones Jr.
9. Organic Chemistry by John McMurry.

Unit III

1. Principles of physical chemistry by Prutton and Marron. The Macmillan Company; 4th 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. Physical Chemistry by Ira Levine (Author) McGraw-Hill Education; 6th Edition (May 9, 2008)

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Unit IV

1. Fundamentals of Analytical Chemistry by Skoog and West, Saunders College Publications, 1982.
2. Text book of organic chemistry by Morrison and Boyd, Pearson Publications (2009).
3. Text book of organic chemistry by Graham Solomons, Wiley Publications (2015)
4. Text book of organic chemistry by Sony, Sultan Chand & Sons; 29th Edition (2012)
5. Text book of organic chemistry by Bruce Yuranis Powla, (2012)
6. General Organic chemistry by Sachin Kumar Ghosh, New Age Publishers Pvt Ltd (2008).
7. Text Book of Physical Chemistry by Soni and Dharmahara. Sulthan Chand and Sons.(2011)
8. Text Book of Physical Chemistry by Puri and Sharma. S. Nagin chandand Co.(2017)

Laboratory Course

Paper III (Organic Synthesis)

45 h (3h/week)

1. Synthesis of Organic Compounds:

Acylation: Preparation of Aspirin and Benzanilide.

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

Three component coupling: One pot synthesis of dihydropyrimidinone

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

Oxidation: Preparation of Benzoic acid

Esterification: Preparation of *n*-Butyl acetate.

Methylation: Preparation of β - Naphthyl methyl ether (Naroline).

Condensation: Preparation of Benzilidine aniline.

Diazotisation: Azo-coupling of β -Naphthol.

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

References:

1. Lab manual for UG students prepared by Department of Chemistry, University College for Women, Koti, Hyd.
2. Practical Organic Chemistry by Mann and Saunders, 1974, Longmann Publications.
3. Comprehensive Practical Organic Chemistry – Preparation and Quantitative Analysis by V. K. Ahluwalia and Renu Aggarwal, Orient Black Swan Publishers, 2004.

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16
Dr. M.S. Radhika, PhD (Nutrition)
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B.Sc. Chemistry II Year Semester-III
Skill Enhancement Course- I (SEC-I) (2 Credits)
Rules in Chemistry Laboratory and Lab Reagents

Unit I: Laboratory Safety Rules and Regulations

15 h (1 hr/week)

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 charts 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. 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 and 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 titrations 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 I: Remedial Methods for Pollution Prevention and control of air pollution
15 h (1hr/week)

Ozone hole-causes and harm due to ozone depletion. The effect of CFCs 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 towers and health hazards.

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 ($B_4O_7^{2-}$), Copper (Cu^{2+}), Iron (Fe^{2+} , Fe^{3+}) Manganese (Mn^{2+}), Molybdenum (MoO_4^{2-}), Zinc (Zn^{2+}), Cobalt (Co^{2+}), Chlorine (Cl) and Others. Determination of soil nitrogen by Kjeldahl method- Illustration through charts (or) demonstration of experiment. Visit to nearby agricultural farms and interaction with farmers. Discussion with farmers on the use of Soil Analysis Kits.

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Unit-I: Chemistry of Cosmetics and Perfumes**15 Hrs**

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, sunscreen lotions, lipsticks, talcum 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 - Aluminium, Zinc, Boric acid, Chloride and Sulphide.

Unit-II: Food Processing and Food Adulteration**15 Hrs**

Food processing: Introduction, principles of food processing, methods of food processing, impact of food processing on nutritive value, additives and preservatives.

Food Packaging: Definition, need, importance, functions, different packaging materials, impact of packaging materials on the nutritive value of foods.

Food labelling: Introduction, need and importance, understanding food labelling.

Food adulteration: Definition, need and importance, common adulterants in foods: cereals, legumes and their products, milk and milk products, fats and oils, spice and condiments, sugars and sugar products and miscellaneous products.

Unit-III: General Characteristics of Drugs**15 Hrs**

Introduction: Diseases – causes of diseases in general, Characteristics of an ideal drug. Drug – definition and sources. **ADME of drugs (brief)** – Absorption, distribution, drug metabolism (in liver), elimination (brief),

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

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

(i) **Oral dosage forms:** Tablets (Ciprofloxacin – antibacterial). Capsules (Amoxycillin – antibiotic). Syrups (Benadryl – Cough syrup).

(ii) **Parenterals:** (Injection forms): Propanolol (antihypertensive)

(iii) **Topical dosage forms:** Creams and Ointments

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

(v) **Anti-itching:** Doxepin, **Antifungal:** Miconazole (Dactarin, Neomicol), **Anaesthetic** – Lidocaine (Lidocaine ointment) and **Antiseptic:** Boro Plus cream, For burns – Iodine ointment.

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Unit – IV: Classification of Drugs

15 Hrs

Classification of drugs based on therapeutic action – Chemotherapeutic agents, pharmacodynamic agents and drugs acting on metabolic processes.

Structure and therapeutic activity for the following:

- (i) **Chemotherapeutic agents:** Antimalarials – chloroquine; Antibiotic – Amoxicillin; Antitubercular drugs – isoniazide; Antiprotozoals – metronidazole.
- (ii) **Pharmacodynamic agents:**
 - (a) Drugs acting on CNS: Diazepam (CNS Depressant), General anaesthetic (thiopental sodium), antipyretic and analgesic (Ibuprofen).
 - (b) Drugs acting on PNS: local anaesthetics (Benzocaine)
 - (c) Drugs acting on cardiovascular system: Metoprolol (antihypertensive agents), Nefidipine (antianginal and antihypertensive agent)
 - (d) Drugs acting on renal system: Diuretics (Acetazolamide)
- (iii) **Drugs acting on metabolic processes:**
 - (a) Vitamins: Common name, source, deficiency, vitamin A, B₂, B₆, C, D, E and K – remedy
 - (b) Hormones: Function (brief) – deficiency of hormones (Insulin, Testosterone and Estrogen).

Recommended Text Books and Reference Books

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., Aug-Sep 2015; 2(4A):304-311.
5. W.A. Poucher, Perfumes, Cosmetics and Soaps (1993).
6. Srilakshmi, Food Science. Edition: 3 rd (2004).
7. Lillian Hoagland Meyer, Food chemistry (2008).
8. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, S. Ranganna, Tata McGraw-Hill Education, 1986 – Food.
9. Fundamental concepts of applied chemistry J.C Ghosh, S. Chand and Co, Ltd, New Delhi.
10. Applied Chemistry K .Bhagavathi Sundhar, MJP publishers.
11. Drugs by G.L.David Krupadanam, D.Vijaya Prasad, K.Varaprasad Rao, K.L.N.Reddy, C.Sudhakar , Universities Press (India) Limited 2007.
12. An Introduction to Medicinal Chemistry by Graham L. Patrick, Oxford University Press, New York. 1995.
13. Chemistry text book for B.Sc., Vol. IV published by Telugu Academy, Govt. of Telangana.
14. A Handbook of food packaging by F. A. Paine and H.Y. Paine.
15. Principles of food packaging by Stanley Sacherow and C Griffin.
16. Food packaging and preservation by M Mathlouthi.
17. Principles of food packaging by R. Heiss.
18. Food packaging (Principles & Practice) by Gordan and L Raboertson.

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B.Sc. Chemistry III Year
Semester-V, Paper-V, BS 506
Discipline Centric Elective - A (4 Credits)
Spectroscopy and Chromatography

60Hrs

Unit I: Molecular Spectroscopy

15Hrs

S5-E-A-I: Introduction to electromagnetic radiation, interaction of electromagnetic radiations with molecules, various types of molecular spectra.

Rotational spectroscopy (Microwave spectroscopy)

Rotational axis, moment of inertia, classification of molecules (based on moment of inertia), rotational energies, selection rules, determination of bond length of rigid diatomic molecules. Eg. HCl.

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, energy levels and selection rules. Modes of vibrations in polyatomic molecules – Linear molecules: HX, CO₂, Acetylene and Non-Linear molecules: NH₃, H₂O and BX₃. Characteristic absorption bands of various functional groups. Finger print nature of infrared spectrum.

Electronic spectroscopy

General features of absorption – spectroscopy, transmittance, absorbance, and molar absorptivity. Bonding and antibonding molecular orbitals, electronic energy levels of molecules (σ , π , n), types of electronic transitions: σ - σ^* , n - σ^* , n - π^* , π - π^* with suitable examples. Selection rules, Terminology of chromophore, auxochrome, bathochromic and hypsochromic shifts. Effect of conjugation on λ_{\max} : diene, enone and aromatic chromophores. Representation of UV-visible spectra. Beer Lambert's law and its limitations, difference between Colorimetry and Spectrophotometry. Verification of Beer's law. Estimation of (i) Chromium and (ii) Manganese.

Unit II: NMR and Mass Spectrometry

15Hrs

S5-E-A-II: Proton Magnetic Resonance Spectroscopy

Magnetic properties of nuclei, Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, factors affecting chemical shifts, NMR splitting of signals – spin-spin coupling, shielding and de-shielding effect, coupling constant, representation of proton NMR spectrum – Integrations. ¹H NMR spectrum of – ethyl bromide, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, acetophenone, benzoic acid and benzaldehyde. Application – Reaction mechanism (cyclic bromonium ion), E-Z isomers, Hydrogen bonding and Keto-enol tautomerism.

Mass Spectrometry

Electron Impact Mass: Basic principles, Nitrogen rule, types of ions: Molecular ion and fragment ions. Representation of mass spectrum, types of peaks (molecular ion peak, base peak and isotopic ion peaks). Ortho effect, Retro Diel's-Alder reaction and McLafferty Rearrangement – Definition with one example each. Determination of molecular formula. Mass spectrum of ethyl chloride, ethyl bromide, acetophenone, benzoic acid and benzamide.

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Unit III: Separation techniques - I

15Hrs

S5-E-A-III: Solvent Extraction- Principle, Methods of extraction: Batch extraction, continuous extraction and counter current extraction. Separation of metals as metal chelates - Determination of Iron (III). **Chromatography:** Classification of chromatographic methods, principles of differential migration, adsorption phenomenon, nature of adsorbents, solvent systems.

Thin layer Chromatography (TLC): Principle, Advantages, preparation of plates, Solid phase and mobile phase used in TLC, elutropic series, development of the chromatogram, Detection of the spots, visualizing agents, factors effecting R_f values and applications of TLC – purity of the sample and monitoring the progress of the reaction.

Paper Chromatography: Principle, choice of paper and solvent systems, development of chromatogram – ascending, descending, radial and two-dimensional chromatography, detection of spots, and applications of paper chromatography.

Unit IV: Separation techniques - II

15Hrs

S5-E-A-IV: Column Chromatography- Principle, Types of stationary phases, Column packing – Wet packing technique, Dry packing technique. Selection criteria of mobile phase solvents for eluting polar, non-polar compounds and its applications.

Ion exchange chromatography: Principle, de-ionized water. Cation and anion exchange resins, its application in separation of ions,

Gas Chromatography: Principle, theory and instrumentation (Block Diagram), Types of stationary phases and carrier gases (mobile phase), applications of GC.

High performance liquid chromatography: Principle, theory and instrumentation, stationary phases and mobile phases. Applications of HPLC, Analysis of paracetamol.

Recommended Text Books and Reference Books

1. Fundamentals of Molecular Spectroscopy by C. N. Banwell and E. M. McCash, fourth Edition, McGraw Hill Education, 1994.
2. Organic spectroscopy, William Kemp, Palgrave Macmillan; 2nd Revised edition (1st February 1987)
3. Analytical Chemistry by David Krupadanam, Universities Press (India) Limited.
4. D.A. Skoog, F.J. Holler, T.A. Nieman, Principles of Instrumental Analysis, Engage earning India Ed.
5. D. A. Skoog, D.M. West, F.J. Holler, Fundamentals of Analytical Chemistry, Sixth Edition, Saunders College Publishing, Fort worth (1992).
6. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.
7. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.2007.
8. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
9. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
10. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16, 1977.
11. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
12. 12. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc, New York (1995).
13. Analytical Chemistry 7 th edition by Gary D. Christian (2004).
14. M.N Sastry, Separation Methods, Paperback (2004), Himalaya Publication.

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B.Sc. Chemistry III Year
Semester-V, Paper-V, BS 506
Discipline Centric Elective-B (4 Credits)
Metallurgy, Dyes and Catalysis

60 Hrs

Unit I: General Principles of Metallurgy and Production of Non Ferrous Metals 15 Hrs

S5-E-B-I: Pyrometallurgy: Drying and calcination, roasting, smelting, products of smelting, Hydrometallurgy: Leaching methods, leaching agents, leaching of metals, oxides and sulphides.

Separation of liquid and solid phases and processing of aqueous solutions

Electrometallurgy: Electrolysis, Refining electrolysis, electrolysis from aqueous solutions, fused-salt electrolysis

Refining processes: Chemical and physical refining processes

Production of selected non-ferrous metals (Copper, Nickel, Zinc): Properties, raw materials, production (flow charts presentations and chemical reactions involved) and uses.

Unit II: Natural and Synthetic Dyes 15Hrs

S5-E-B-II: Dyes: Definition, Classification of dyes- Natural dyes, synthetic dyes; based on chemical constitution of dyes; Chemical nature of dyes; Applications of dyes.

Structures of natural dyes: Indigo, Tyrian purple, Alizarin, Indigotin.

Structures of Synthetic Dyes: Nitrodyes, Nitrosodyes, Azodyes (Mono azodyes, bisazodyes), diaryl methane dyes, triaryl methane dyes, Xanthene dyes, Phenolphthalein, Fluorocetin, Acridine dyes.

Synthesis of dyes: Mono azodyes, bisazodyes (Congo red), Auromine O, Malachite Green, Crystal Violet, Rhodamine B, Acridine Yellow, Indigotin .

Binding of dyes to fabric. Applications of dyes.

Unit III: Catalysis I 15Hrs

S5-E-B-III: 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 and base catalysed reactions, hydrolysis of esters. Kinetics of acid catalysed reactions. Specific acid and general acid catalysis, Kinetics of base catalysed reactions. Specific base and general base catalysis. Examples-Aldol condensation and decomposition of nitramide, base catalysed conversion of acetone to di acetone alcohol. Mutarotation of glucose, Effect of pH on reaction rate of acid and base catalysed reactions.

Phase transfer catalysis: Principle of phase transfer catalysis, classification of phase transfer catalysts. Factors influencing the rate of PTC reactions.

Unit IV: Catalysis II 15Hrs

S5-E-B-IV: Enzyme catalysis- Characteristics of enzyme catalysis, Examples: (i) Invertase in inversion of cane sugar (ii) Maltase in conversion of maltose to glucose (iii) Urease in decomposition of urea (iv) Zymase in conversion of glucose to ethanol (v) working of carbonic anhydrase and (vi) Mechanism of oxidation of ethanol by alcohol dehydrogenase Factors

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affecting enzyme catalysis. Effect of temperature, pH, concentration and effect of inhibitor on enzyme catalysed reactions, Catalytic efficiency.

Kinetics of enzyme catalysed reactions: Michaelis-Menton Equation. Mechanism of enzyme catalysed reactions. Significance of Michaelis constant (K_m) and maximum velocity (V_{max}), Lineweaver-Burk plot. Types of enzyme inhibitors

Recommended Text Books and Reference Books

1. Industrial Chemistry E. Stocchi, Vol-I, Ellis Horwood Ltd. UK.
2. Elementary Principles of Chemical Processes, R.M. Felder, R.W. Rousseau: Wiley Publishers, New Delhi.
3. Handbook of Industrial Chemistry, J. A. Kent: Riegel's, CBS Publishers, New Delhi.
4. Theory of production of non-ferrous metals and alloys Study. Kateřina Skotnicová, Monika Losertová, Miroslav Kurša
5. The Chemistry of Synthetic Dyes, Volume 4, K Venkataraman Elsevier, Technology & Engineering.
6. Organic Chemistry Vol-I by I.L. Finar.
7. Organic Chemistry by Jennice, Gorzinski Smith
8. Natural Dyes: Sources, Chemistry, Application and Sustainability Issues by Sujata Saxena and A. S. M. Raja.
9. Physical Chemistry by Atkins and De Paula, 8 th Edn.
10. Physical Chemistry by Puri, Sharma and Pattania, 2017.
11. Kinetics and mechanism of chemical transformations by Rajarajm and Kuriacose, Published by Macmillan India Ltd.
12. Text book of Physical Chemistry by K.L. Kapoor Macmillan, 1999.
13. Catalysis by J.C. Kuriacose, Macmillan Macmillan Publishers India Limited, 1980.

Handwritten signatures and dates in green ink:

- 27/4/21
- M-S-R
- Dr. M.S. RADHIKA, PhD (Nutrition)
- Science-E & Head of the Department
- आहारविज्ञानविभाग, आईसीएमआर-राष्ट्रीयपोषणसंस्थान
- Department of Dietetics, ICMR-National Institute of Nutrition
- जामि-उस्मानिया (पोस्ट), सिकंदराबाद-500 008, भारत
- Jammi-Osmania (PO), Secunderabad 500 007, INDIA

Other signatures: Palle, kavit, M-S-R, and several other illegible signatures.

Semester - V
Laboratory Course - V
Experiments in Physical Chemistry-I

Physical Chemistry

45 h (3 h / w)

1. Distribution law

- a) Determination of molecular status and partition coefficient of benzoic acid in Toluene and water.
- b) Determination of distribution coefficient of acetic acid between n-butanol and water.

2. Electrochemistry

- a) Determination of concentration of HCl conductometrically using standard NaOH solution.
- b) Determination of concentration of CH₃COOH conductometrically using standard NaOH solution.
- c) Determination of cell constant of a conductivity cell.
- d) Verification of Ostwald's dilution law- Determination of dissociation constant (K_a) of acetic acid by conductivity measurements.

3. Colorimetry

- a) Verification of Beer's law and Determination of the concentration of KMnO₄ solution.
- b) Verification of Beer's law and Determination of the concentration of CuSO₄ solution.

4. Adsorption

- b) Adsorption of acetic acid on animal charcoal - Verification of Freundlich adsorption isotherm.

5. Physical constants

- a) Surface tension and b) viscosity of liquids. (Demonstration Experiment)

[Handwritten signatures and dates in blue and green ink]

27/4/21

M-S-N

H. Kasid

Palle

