MAHATMA GANDHI UNIVERSITY
NALGONDA

DEPARTMENT OF CHEMISTRY

Common Syllabus for All Universities in Telangana

SYLLABUS OF
B.Sc. CHEMISTRY

(Effective from academic year 2025 – 2026 onwards)

CHAIRPERSON
Board of Studies
Dept. of Chemistry
University College of Science,
M.G. University, Nalgonda-508254

HEAD
Dept. of Chemistry
University College of Science,
M.G. University, Nalgonda-508254

Telangana Council of Higher Education (TGCHE)
Govt. of Telangana

Common Syllabus for All Universities in Telangana

SYLLABUS OF
B.Sc. CHEMISTRY

(Effective from academic year 2025 – 2026 onwards)

TELANGANA 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
(Effective from the academic year 2025 – 2026 onwards)

FIRST YEAR-SEMESTER I				
CODE	**COURSE TITLE**	**COURSE TYPE**	**HPW**	**CREDITS**
BS 101	**Major – 1: Chemistry – I** **Laboratory Course – I** **(Quantitative Analysis – Titrations)**	DSC-1A	4T+2P = 6	4+1 = 5
BS 102	Major - 2	DSC-2A	4T+2P = 6	4+1 = 5
BS 103	Minor	DSC-3A	4T+2P = 6	4+1 = 5
BS 104	English	AEC-1A	5	5
BS 105	Second Language	AEC-2A	5	5
	TOTAL CREDITS		**28**	**25**
FIRST YEAR-SEMESTER II				
BS 201	**Major – 1: Chemistry – II** **Laboratory Course - II** **(Qualitative Analysis - Semi Micro Analysis of Mixtures)**	DSC-1B	4T+2P = 6	4+1 = 5
BS 202	Major - 2	DSC-2B	4T+2P = 6	4+1 = 5
BS 203	Minor	DSC-3B	4T+2P = 6	4+1 = 5
BS 204	English	AEC-1B	5	5
BS 205	Second Language	AEC-2B	5	5
	TOTAL CREDITS		**28**	**25**
SECOND YEAR-SEMESTER III				
CODE	**COURSE TITLE**	**COURSE TYPE**	**HPW**	**CREDITS**
BS 301	**Major – 1: Chemistry – III** **Laboratory Course - III** **(Synthesis of Organic compounds)**	DSC-1C	4T+2P = 6	4+1 = 5
BS 302	Major - 2	DSC-2C	4T+2P = 6	4+1 = 5
BS 303	Minor	DSC-3C	4T+2P = 6	4+1 = 5
BS 304	English	AEC-1C	5	5
BS 305	Second Language	AEC-2C	5	5
	TOTAL CREDITS		**28**	**25**
SECOND YEAR-SEMESTER IV				
BS 401	**Major – 1: Chemistry – IV** **Laboratory Course - IV** **(Qualitative Analysis of Organic Compounds)**	DSC-1D	4T+2P = 6	4+1 = 5
BS 402	Major - 2	DSC-2D	4T+2P = 6	4+1 = 5
BS 403	Minor	DSC-3D	4T+2P = 6	4+1 = 5
BS 404	English	AEC-1D	5	5
BS 405	Second Language	AEC-2D	5	5
	TOTAL CREDITS		**28**	**25**

THIRD YEAR-SEMESTER V				
CODE	**COURSE TITLE**	**COURSE TYPE**	**HPW**	**CREDITS**
BS 501	**Major – 1: Chemistry – V A/B** **A. Spectroscopy and Chromatography** **(Or)** **B. Metallurgy, Dyes, Batteries and Nanomaterials** **Laboratory Course – V** **(Experiments in Physical Chemistry)**	DSC-1E	4T+2P = 6	4+1 = 5
BS 502	Major - 2	DSC-2E	4T+2P = 6	4+1 = 5
BS 503	**MDC: Foundations of Chemistry – Concepts and Applications**	MDC-1	4	4
BS 504	Skill Enhancement Course – 1: **Rules in Chemistry Laboratory and Lab Reagents**	SEC-1	2	2
BS 505	Skill Enhancement Course – 2: **Effects of pollution & control of water Pollution, Drinking Water Treatment and Soil Analysis**	SEC-2	2	2
BS 506	Value Added Course - 1	VAC-1	3	3
	TOTAL CREDITS		**23**	**21**

THIRD YEAR-SEMESTER VI				
BS 601	**Major – 1: Chemistry – VI A/B** **A. Medicinal Chemistry** **(Or)** **B. Agricultural and Fuel Chemistry** **Laboratory Course - VI** **(Experiments in Physical Chemistry)**	DSC-1F	4T+2P = 6	4+1 = 5
BS 602	Major – 2 (A/B)	DSC-2F	4T+2P = 6	4+1 = 5
BS 603	Skill Enhancement Course – 3: **Materials and their Applications**	SEC-3	2	2
BS 604	Skill Enhancement Course – 4: **Chemistry of Cosmetics and Food Processing**	SEC-4	2	2
BS 605	Value Added Course - 2	VAC-2	3	3
BS 606	Internship/ Project Work		4	4
	TOTAL CREDITS		**23**	**21**
	GRAND TOTAL			**142**

Credits under Non-CGPA
(Community Engagement & Service)

1.	NSS/NCC/Sports/Extracurricular	Up to 6 Credits (2 in each year)
2.	IKS	Up to 4 (2 in each, after I & II years)

Major – 1	30
Major – 2	30
Minor	20
AEC (Ability Enhancement Course) – English	20
Second Language	20
MDC (Multi-Disciplinary Course)	4
SEC (Skill Enhancement Course)	8
VAC (Value Added Course)	6
Project	4
Total	**142**

B.Sc. I YEAR CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER I
Paper – I
Chemistry – I

15h (1 h/week)

Unit-I (Inorganic Chemistry)

15h

S1-I-1: Chemistry of P-Block Elements

Structure and bonding in diborane (B_2H_6), Boron nitrogen compounds ($B_3N_3H_6$ and BN), Lewis acid nature of BX_3.

Carbides- Classification -ionic, covalent, interstitial-Structures and reactivity. Industrial applications. Silicones-Classification-straight chain, cyclic and cross-linked and applications.

Nitrides-Classification -ionic, covalent and interstitial- Reactivity – hydrolysis.

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

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

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

Pseudohalogens: Comparison with halogens.

Structure, bonding and reactivity of Xenon Compounds-Oxides, Halides and Oxy-halides.

15h (1 h/week)

Unit - II (Organic Chemistry)

5h

S1-O-1: Structural Theory in Organic Chemistry

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.

5h

S1-O-2: Acyclic Hydrocarbons

Alkanes– Methods of preparation: Preparation of Alkanes from Grignard reagent. Chemical reactivity-inert nature, free radical substitution, Halogenation example.

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, Markovnikov's rule, addition of H_2O, HOX with mechanism and addition of HBr in the presence of peroxide (anti–Markovnikov's addition). Oxidation (cis–additions) hydroxylation by $KMnO_4$, OsO_4, anti-addition- peracids (via epoxidation), ozonolysis – location of double bond.

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) and reduction (catalytic hydrogenation).

S1-O-3: Aromatic Hydrocarbons **5h**

Introduction to aromaticity: Huckel's rule – Benzene, Naphthalene and Anthracene. Reactions - General mechanism of electrophilic substitution, mechanism of nitration, sulphonation and halogenation, Friedel Crafts 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 (1h/week)**

S1-P-1: Elementary quantum mechanics **3h**

Limitations of classical mechanics and Origin of quantum mechanics-Black body radiation, Rayleigh Jeans law; Planck's radiation law, photoelectric effect, Compton effect, de Broglie's hypothesis. Heisenberg's uncertainty principle. Schrödinger wave equation (derivation not required) – significance of ψ and ψ^2.

S1-P-2: Chemical Kinetics **8h**

Introduction to chemical kinetics, rate of reaction, rate laws and rate constant. Molecularity and Order of a reaction. Factors influencing the reaction rates. 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, Example - Decomposition of H_2O_2. 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, example-Saponification of ester. Characteristics of second order reaction, units for rate constants, half- life period and second order plots. Problems. Methods for determining the order of a reaction. Arrhenius equation – activation energy -problems.

S1-P-3: Photochemistry **4h**

Introduction to photochemistry – differences between dark and photo reactions. Laws of photochemistry; Quantum Yield – problems; Examples of photo chemical reactions with different quantum yields. Photo chemical combinations of H_2–Cl_2 and H_2–Br_2 reactions. Abnormal quantum yield – high and low-examples with reasons. Singlet and triplet states. Jablonski diagram – non-radiative processes – Internal conversion and Intersystem crossing; radiative processes- Fluorescence and phosphorescence.

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

S1-G-1. General Principles of Inorganic quantitative Analysis: **5h**

Volumetric Analysis: Introduction, standard solutions, indicators, end point, titration curves, Types of titrations: i) neutralization titration- principle, theory of acid base indicators, titration curves and selection of indicators- strong acid - strong base, strong acid –weak base, weak acid- strong base and weak acid –weak base. Theory of redox titrations – internal ($KMnO_4$) and external indicators – use of diphenylamine and ferroin indicators. Theory of complexometric titrations – use of EBT, Murexide and Fast sulphone black indicators. Role of pH in complexometric titrations. Precipitation titrations – theory of adsorption indicators.

S1-G-2. Isomerism **5h**

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, Sawhorse, Newmann projection 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. Cis-trans isomerism: E-Z-Nomenclature.

S1-G-3 Colloids & Surface Chemistry **5h**

Colloids: Definition of colloids-classification of colloids-examples. Solid in liquid (sol)-Preparation, kinetic and electrical properties, stability and protection of colloids - Hardy-Schulze rule and Gold number. Liquid in liquid (emulsion)-types of emulsions and emulsifier. Liquid in solid (gel)-types and properties. Applications of colloids.

Adsorption: Types of adsorptions; Factors influencing adsorption; Freundlich adsorption isotherm and Langmuir adsorption isotherm. Applications.

References

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

Unit- I

1. Puri, B. R., Sharma, L. R., & Kalia, M. S. (1996). Principles of inorganic chemistry. Vishal Publications.
2. Lee, J. D. (1981). Concise inorganic chemistry (3rd ed.). Oxford University Press.
3. Cotton, F. A., Wilkinson, G., & Gaus, P. L. (2001). Basic inorganic chemistry (3rd ed.). Wiley.
4. Huheey, J. E., Keiter, E. A., & Keiter, R. L. (1993). Inorganic chemistry: Principles of structure and reactivity (4th ed.). Harper Collins College Publishers.
5. Greenwood, N. N., & Earnshaw, A. (1989). Chemistry of the elements. Pergamon Press.
6. Shriver, D. F., & Atkins, P. W. (1999). Inorganic chemistry (3rd ed.). Oxford University Press.
7. Gopalan, R. (2009). Textbook of inorganic chemistry. Universities Press.

Unit- II

1. Morrison, R. T., & Boyd, R. N. (2011). Organic chemistry. Pearson Education (Prentice Hall).
2. Solomons, T. W. G., & Fryhle, C. B. (2016). Organic chemistry. Wiley (John Wiley & Sons).
3. Bruice, P. Y. (2017). Organic chemistry. Pearson Education.
4. Wade, L. G., Jr. (2013). Organic chemistry. Pearson Education.
5. Jones, M., Jr. (2010). Organic chemistry. W. W. Norton & Company.
6. McMurry, J. (2015). Organic chemistry. Cengage Learning (Brooks/Cole).
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8. Ghosh, S. K. (2009). General organic chemistry. Bharati Bhawan Publishers.
9. Pillai, C. N. (2008). Organic chemistry. Universities Press (India) Pvt. Ltd.

Unit III

1. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2013). Principles of physical chemistry (46th ed.). Vishal Publishing Company.
2. Raj, G. (2009). Advanced physical chemistry (35th ed.). Goel Publishing House.
3. Lewis, G., & Glasstone, S. (1966). Elements of physical chemistry. Macmillan.
4. Atkins, P. W. (2001). Physical chemistry (7th ed.). Oxford University Press.
5. Kapoor, K. L. (1994). A textbook of physical chemistry (Vols. 4 & 5). Macmillan India Ltd.
6. Laidler, K. J. (1987). Chemical kinetics (3rd ed.). McGraw Hill.
7. Rajaraman, J., & Kuriacose, J. (1993). Kinetics and mechanism of chemical transformations. Macmillan India.
8. Turro, N. J. (1978). Molecular photochemistry. W. A. Benjamin, Inc.
9. Rohatgi-Mukherjee, K. K. (1978). Fundamentals of photochemistry. Wiley Eastern.
10. Dogra, S. K., & Dogra, S. (1996). Physical chemistry through problems (4th ed.). New Age International.
11. Kalidas, C., & Sangaranarayanan, M. V. (2019). Physical chemistry: Problems and solutions. Universities Press.

Unit IV

1. Jeffery, G. H., Bassett, J., Mendham, J., & Denney, R. C. (1999). Vogel's textbook of quantitative chemical analysis (5th ed.). Addison Wesley Longman Inc.
2. Day, R. A., & Underwood, A. L. (2004). Quantitative analysis (6th ed.). Prentice Hall of India.
3. Svehla, G. (1996). Vogel's qualitative inorganic analysis (7th ed.). Prentice Hall.
4. Morrison, R. T., & Boyd, R. N. (2011). Organic chemistry. Pearson Education.
5. Solomons, T. W. G., & Fryhle, C. B. (2016). Organic chemistry. Wiley.
6. Bruice, P. Y. (2017). Organic chemistry. Pearson Education.
7. Soni, P. L. (2012). Textbook of organic chemistry. Sultan Chand & Sons.
8. Levine, I. N. (2009). Physical chemistry (6th ed.). McGraw Hill.
9. Kapoor, K. L. (1994). A textbook of physical chemistry (Vols. 4 & 5). Macmillan India Ltd.
10. Atkins, P., & de Paula, J. (2010). Atkins' physical chemistry (9th ed.). Oxford University Press.
11. McQuarrie, D. A., & Simon, J. D. (1997). Physical chemistry: A molecular approach. Viva Books Pvt. Ltd.
12. Satake, M., Hayashi, Y., Mido, Y., Iqbal, S. A., & Sethi, M. S. (2014). Colloidal and surface chemistry. Discovery Publishing Pvt. Ltd.

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

Paper-I: 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.

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+} by EDTA
2. Estimation of Cu^{2+} by EDTA

References

1. Jeffery, G. H., Bassett, J., Mendham, J., & Denney, R. C. (1999). Vogel's textbook of quantitative chemical analysis (5th ed.). Addison Wesley Longman Inc.
2. Vogel, A. I. Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2000. ISBN: 9780582226289
3. Giri, A. N. (2010). A textbook of practical chemistry. Himalaya Publishing House.
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6. Gopalan, R., Venkappayya, D., and Nagarajan, S. (2012). Textbook of Inorganic Chemistry (Lab Manual), 3rd Edition, Universities Press, Hyderabad, ISBN: 9788173718204
7. Ahluwalia, V. K., and Sunita Dhingra, (2005). A Laboratory Manual of Organic and Inorganic Chemistry, 1st Edition, University Press, Hyderabad, ISBN: 9788173715623

B.Sc I YEAR CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER II
Paper – II
Chemistry – II

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

S2-I-1 Chemistry of d-block elements **7h**

Characteristics of d-block elements with special reference to electronic configuration, variable oxidation states, color properties, d-d spectral transitions, ability to form complexes, magnetic properties, calculation of magnetic moment-spin only formula & catalytic properties. Comparative treatment of second and third transition series with their 3d analogues.

S2-I-2: Chemistry of f-block elements **8h**

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

Chemistry of actinides: General features-electronic configuration, oxidation state, actinide contraction, color and complex formation. Comparison with lanthanides.

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

S2-O-1: Halogen compounds **4h**

Classification: alkyl (primary, secondary, tertiary), aryl, aralkyl,. 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 (Racemization) 1- bromo-1-phenylpropane.

S2-O-2: Hydroxy compounds and ethers **5h**

Alcohols: 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), oxidation with conc. HNO_3 and Oppenauer oxidation (Mechanism).

Phenols: Preparation: (i) from diazonium salts of anilines and (ii) from benzene sulphonic acids. Properties: Acidic nature, formation of phenoxide and reaction with R-X, electrophilic substitution: halogenations, Riemer Tiemann reaction (Mechanism), Gattermann-Koch reaction, Schotten-Baumann reaction.

Ethers: Nomenclature, preparation by Williamson synthesis. Chemical properties – inert nature, action of conc. H_2SO_4.

S2-O-3 Carbonyl compounds **6h**

Preparation of aldehydes & ketones from acid chlorides, nitriles and carboxylic acids. Special methods of preparing aromatic aldehydes and ketones by Oxidation of arenes. Physical properties – absence of Hydrogen bonding. Reactivity of the carbonyl groups in aldehydes and ketones. Chemical reactivity: Addition of (a) $NaHSO_3$ (b) HCN (c) RMgX (d) 2,4-DNP (Schiff base). Addition of H_2O to form hydrate, addition of alcohols - hemi acetal and acetal formation. Cannizzaro reaction. Oxidation reactions – $KMnO_4$ oxidation, reduction – catalytic hydrogenation, mechanism of Clemmensen reduction, Meerwein-Ponndorf-Verley reduction.

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

S2-P-1: Electrochemistry **15h**

Revision of conductance, specific conductance, equivalent conductance and factors influencing conductance of electrolytes. Ionic mobility, definition and significance of transport number. Kohlrausch's law – its applications: determination of degree of dissociation and acid dissociation constant (K_a) of weak acids, solubility product determination and conductometric titrations. Ostwald's dilution law - its uses and limitations. Debye- Hückel -Onsager's equation for strong electrolytes (elementary treatment only).

Types of electrodes with examples - Types of reversible electrodes - the gas electrode, metal-metal ion, metal-insoluble salt, redox electrodes and ion-selective electrode. Reversible and irreversible cells; Nernst equation – EMF of a cell; representation of a cell-problems; electrode potentials-electrochemical series and its significance. Determination of pH – using quinhydrone and glass electrodes. Potentiometric titrations.

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

S2-G-1: Chemical Bonding **5h**

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

S2-G-2: Stereoisomerism **5h**

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

center and S_n axis of symmetry – asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and dissymmetric 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 (CIP) rules.

S2-G-3: Colligative Properties **5h**

Definition of colligative properties- relative lowering of vapour pressure-Raoult's law; Osmotic pressure; elevation of boiling point and depression of freezing point; thermodynamic relation between molecular weight and colligative property (derivations not required) -Problems.

References

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

Unit I

1. Puri, B. R., Sharma, L. R., & Kalia, M. S. (1996). Principles of inorganic chemistry. Vishal Publications.
2. Lee, J. D. (1981). Concise inorganic chemistry (3rd ed.). Oxford University Press.
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Unit II

1. Morrison, R. T., & Boyd, R. N. (2011). Organic chemistry. Pearson Education (Prentice Hall).
2. Solomons, T. W. G., & Fryhle, C. B. (2016). Organic chemistry. Wiley (John Wiley & Sons).
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8. Ghosh, S. K. (2009). General organic chemistry. Bharati Bhawan Publishers.
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Unit III

1. Glasstone, S., & Lewis, D. (1966). Elements of physical chemistry. Macmillan.
2. Maron, S. H., & Lando, J. B. (1966). Fundamentals of physical chemistry. Macmillan Limited.
3. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2013). Principles of physical chemistry (46th ed.). Vishal Publishing Company.
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7. Dogra, S. K., & Dogra, S. (1996). Physical chemistry through problems (4th ed.). New Age Int.
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Unit IV

1. Day, R. A., & Underwood, A. L. (2004). Quantitative analysis (6th ed.). Prentice Hall of India.
2. Atkins, P. W. (2001). Physical chemistry (7th ed.). Oxford University Press.
3. Kapoor, K. L. (2004). Physical chemistry (Vols. 3 & 5). Macmillan Publishers.
4. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2013). Principles of physical chemistry (46th ed.) Vishal Publishing Company.
5. Raj, G. (2009). Advanced physical chemistry (35th ed.). Goel Publishing House.

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

Paper II - 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^-, I^-, CH_3COO^-, NO_3^-, PO_4^{3-}, BO_3^{3-}, SO_4^{2-}
Cations: Hg_2^{2+}, Ag^+, Pb^{2+},
Hg^{2+}, Bi^{3+}, Cd^{2+}, Cu^{2+}, As^{3+} / As^{5+} , Sb^{3+} / Sb^{5+}, Sn^{2+} / Sn^{4+},
Al^{3+}, Cr^{3+}, Fe^{3+}
Mn^{2+}, Co^{2+}, Ni^{2+}, Zn^{2+}
Ca^{2+}, Ba^{2+}, Sr^{2+}
Mg^{2+}, NH_4^+

References

1. Svehla, G. (1996). Vogel's qualitative inorganic analysis (7th ed.). Prentice Hall.
2. Gopalan, R., Subramanian, P. S., & Raghavan, K. (2004). Elements of analytical chemistry. Sultan Chand & Sons.
3. Ahluwalia, V. K., and Sunita Dhingra, (2005). A Laboratory Manual of Organic and Inorganic Chemistry, 1st Edition, University Press, Hyderabad, ISBN: 9788173715623
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B.Sc II YEAR CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER III
Paper-III
Chemistry - III

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

S3-I-1: Coordination Compounds-I **10h**

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 $[Ni(NH_3)_4]^{2+}$, $[NiCl_4]^{2-}$ and $[Ni(CO)_4]$ (b) Square planar complexes $[Ni(CN)_4]^{2-}$, $[Cu(NH_3)_4]^{2+}$, $[PtCl_4]^{2-}$ (c) Octahedral complexes $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$, $[FeF_6]^{4-}$, $[Co(NH_3)_6]^{3+}$, $[CoF_6]^{3-}$ Limitations of VBT. 3. Isomerism in coordination compounds, stereo isomerism-(a) Geometrical isomerism in (i) Square planar metal complexes of the type$[MA_2B_2]$, $[MA_2BC]$, $[M(AB)_2]$, [MABCD]. (ii) Octahedral metal complexes of the type $[MA_4B_2]$, $[M(AA)_2B_2]$, $[MA_3B_3]$ using suitable examples, (b) Optical isomerism in (i). tetrahedral complexes [MABCD], (ii). Octahedral complexes $[M(AA)_2B_2]$, $[M(AA)_3]$ using suitable examples. Structural isomerism: ionization, linkage, coordination ligand isomerism using suitable examples.

S3-I-2: Metal Carbonyls and related compounds **2h**

Metal Carbonyls: Classification, Structural features of $Ni(CO)_4$, $Fe(CO)_5$, $Fe_2(CO)_9$, $Fe_3(CO)_{12}$ and $Cr(CO)_6$ -18 valence electron rule.

S3-I-3: Organometallic Chemistry **3h**

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

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

S3-O-1: Carboxylic acids **6 h**

Preparation: (a) Hydrolysis of Nitriles, amides and esters. (b) Carbonation of Grignard reagents. Special methods of preparation of Aromatic Acids - Oxidation of Arenes. Physical properties-hydrogen bonding, dimeric association, Chemical properties – Reactions involving H, OH and COOH groups -salt formation, anhydride formation, Acid halide formation, Esterification (mechanism) & Amide formation. Reduction of acid to the corresponding primary alcohol - via ester or acid chloride. Arndt – Eistert synthesis, Halogenation by Hell – Volhard - Zelinsky reaction.

S3-O-2: Nitro hydrocarbons **4h**

Preparation of Nitroalkanes. Reactivity - halogenation, reaction with HNO_2 (Nitrous acid), Nef reaction, reduction. Aromatic Nitro hydrocarbons: Preparation of Nitrobenzene by Nitration. Physical properties, chemical reactivity –Reduction of Nitrobenzene in different media.

S3-O-3: Amines **5h**

Amines: classification into 1°, 2°, 3° Amines and quaternary ammonium compounds. Preparative methods – Ammonolysis of alkyl halides, Gabriel synthesis, Hoffmann bromamide reaction (mechanism). Reduction of Amides and Schmidt reaction. Physical properties. Chemical Properties: a) Alkylation b) Acylation c) Carbylamine reaction d) Hinsberg separation. Reaction with Nitrous acid of 1°, 2°, 3° amines (aliphatic and aromatic). Electrophilic substitutions of Aromatic amines – Bromination and Nitration.

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

S3-P-1: Solid state Chemistry **6h**

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

S3-P-2: Catalysis **9h**

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

Acid-base catalysis- Specific acid and general acid catalysis- Examples, Specific base and general base catalysis – Examples. Effect of pH on reaction rate of acid and base catalysed reactions.

Enzyme catalysis- Characteristics of enzyme catalysis, Examples: Factors affecting enzyme catalysis. Effect of temperature, pH, concentration and effect of inhibitor on enzyme catalysed reactions, Catalytic efficiency. Michaelis-Menten Equation (Derivation not required). Significance of Michaelis constant (K_m) and maximum velocity (V_{max}), Lineweaver-Burk plot.

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

S3-G-1 Bioinorganic Chemistry: **5h**

Essential elements, biological significance of Na, K, Mg, Ca, Fe, Co, Ni, Cu, Zn and chloride (Cl^-). Toxicity of Cd, As, Hg and Pb. Oxygen transport and storage: structure of hemoglobin, binding and transport of oxygen. Fixation of CO_2 in photosynthesis.

S3-G-2: Heterocyclic Compounds **5h**

Introduction and definition: 5-membered ring compounds with one hetero atom Ex. pyrrole, furan and thiophene. Importance of ring systems – and numbering in heterocyclic compounds. Aromatic character, Resonance structures: Explanation of feebly acidic character of pyrrole, preparation of pyrrole, furan and thiophene Paal-Knorr synthesis. electrophilic substitution, halogenation, nitration and sulfonation. Basicity, aromaticity of pyridine – comparison with pyrrole – preparation by Hantzsch method and properties – reactivity towards nucleophilic substitution reaction – Chichibabin reaction.

S3-G-3: Phase Rule **5h**

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.

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

Unit- I

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Unit- II

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Unit III

1. Prutton, C. F., & Marron, H. A. (1970). Principles of physical chemistry (4th ed.). The Macmillan Company.
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3. Puri, B. R., & Sharma, L. R. (2017). Textbook of physical chemistry. S. Nagin Chand & Co.
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Unit IV

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Laboratory Course-III

Paper III (Organic Synthesis) **30h (2h / week)**

1. Synthesis of Organic compounds:

Acetylation: Acetylation of salicylic acid.

Aromatic electrophilic substitution: Nitration: Preparation of nitro benzene.

Halogenation: Preparation of p-bromo acetanilide.

Oxidation: Preparation of benzoic acid from benzyl chloride.

Methylation: Preparation of - naphthyl methyl ether.

Condensation: Preparation of benzilidine aniline and Benzaldehyde and aniline. Diazotisation: azocoupling of β-Naphthol.

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

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B.Sc. II YEAR CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER IV
Paper-IV Chemistry - IV

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

S4-I-1: Coordination Compounds –II **12h**

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

S4-I-2: 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.

S4-I-3: Stability of metal Complexes: **3h**

Thermodynamic and kinetic stability of transition of metal complexes. Stability of metal complexes –stepwise and overall stability constant and their relationship. Determination of composition of complex by Job's method and mole ratio method.

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

S4-O-1: Carbohydrates **8h**

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: Evidences for straight chain penta-hydroxy aldehyde structure. Number of optically active isomers possible for the structure, configuration of 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, Cyclic structure for fructose (Furanose structure, Haworth formula).

Inter Conversion of Monosaccharides: Arabinose to D-glucose, D- mannose (Kiliani – Fischer method). D-glucose to D-arabinose by Ruff degradation. Aldohexose(+) (glucose) to ketohexose (–) (fructose) and Ketohexose(Fructose) to aldohexose (Glucose).

S4-O-2: Amino acids and proteins **7h**

Classification. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples – Glycine, Alanine, and Valine) by following methods: a) From halogenated Carboxylic acid b) Malonic ester 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 – Lactam from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides.

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

S4-P-1: Thermodynamics **15h**

Revision of terms of thermodynamics: I law of thermodynamics-statements-concepts of Internal energy, enthalpy, heat capacity, work and heat. Expression for work done in isothermal and adiabatic processes -reversible (PV^{γ} = constant) and irreversible processes – problems. Heat capacities at constant pressure and volume. Derivation of C_p-C_v = R.

Limitations of I law-scope of II law- statements of second law of thermodynamics. Spontaneous and non-spontaneous processes, spontaneity and equilibrium. Cyclic process - Carnot cycle-derivation of efficiency based on entropy concept – problems. Physical significance of entropy. Change in entropy of an ideal gas as a function of P, V and T. Entropy changes of an ideal gas in various processes. Entropy as a criterion for spontaneity. Free energy–Gibb's free energy & Helmholtz free energy (work function), relation between w and ΔA and ΔG. Free energy - Variation of G with T,V and P- problems. Derivation of equation $\Delta G = \Delta H - T\Delta S$. ΔG as criteria of equilibria or spontaneity of a reaction.

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

S4-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

S4-G-2: Carbanions **5h**

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 smaller alkynes to higher alkynes. Mannich reaction, Michael addition and Knoevenagel condensation Synthetic applications of Aceto acetic ester. Acid hydrolysis and ketonic hydrolysis.

S4-G-3: AI (Artificial Intelligence) applications in Chemistry **6h**

Introduction to AI :

Definition of AI; Machine Learning (ML) and Types: Supervised, Unsupervised, Reinforcement Learning, AI vs. Traditional Programming. (Only conceptual information, very brief). Examples in daily life (voice assistants, image recognition)

AI Tools in Chemistry :

Usage of AI in Chemistry - Prediction of physical properties (solubility, pKa, boiling points) ; Molecular property prediction (toxicity, bioactivity)

Chemical Data Formats: Datasets and Descriptors Chemical data- SMILES, InChI, Molecular descriptors (size, shape, polarity),

Popular Free Chemical Databases: PubChem, ChemSpider, ChEMBL AI in drug design

Basics of Using AI Tools

Introduction to user-friendly tools like: ACD/Labs, MoleculeNet, ChemRxiv AI, ChatGPT for quick analysis Case study: Predicting solubility or boiling point of compounds (e.g., ethanol. Caffeine) using a free ML tool

Ethics, Limitations & Future Scope in Chemistry

Limitations of AI in science, Ethics in data and model predictions

References

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

Unit- I

1. Puri, B. R., Sharma, L. R., & Kalia, M. S. (1996). Principles of inorganic chemistry. Vishal Publications.
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Unit III

1. Maron, S. H., & Lando, J. B. (1966). Fundamentals of physical chemistry. Macmillan Limited.
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8. ACD/Labs ChemSketch (Freeware) – Draw molecules, get properties, IUPAC names Link: https://www.acdlabs.com/resources/free-chemistry-software-apps/chemsketch-freeware
9. MoleculeNet (AI-ready datasets for chemical properties) Website: https://moleculenet.org
10. ChemRxiv (Chemistry Preprint Server) Website: https://chemrxiv.org
11. ChatGPT (AI chatbot for Q&A and explanations) Website: https://chat.openai.com
12. PubChem Website: https://pubchem.ncbi.nlm.nih.gov
13. ChemSpider Website: http://www.chemspider.com Maintained by: The Royal Society of Chemistry
14. ChEMBL Website: https://www.ebi.ac.uk/chembl Maintained by: The European Bioinformatics Institute (EMBL-EBI)

Laboratory Course -IV

Qualitative Analysis of Organic Compounds: **30h (2h/week)**

Qualitative analysis: Identification of unknown organic compounds through the functional group analysis - ignition test, solubility test, functional group tests and preparation of suitable derivatives of the following: Carboxylic acids, phenols, amines, carbohydrates, aldehydes, ketones, ester and naphthalene.

References

1. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. (1989). Vogel's textbook of practical organic chemistry (5th ed.). Longman.
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B.Sc. Chemistry III Year
Semester-V, Paper-V
Discipline Centric Elective- A (4 Credits)
Spectroscopy and Chromatography **(60 Hours)**

Unit I: Molecular spectroscopy **15h (1h/week)**

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 and energy levels. Modes of vibrations in polyatomic molecules. Characteristic absorption bands of various functional groups. Finger print nature of infrared spectrum.

Electronic spectroscopy:

Bonding and antibonding molecular orbitals, electronic energy levels of molecules (σ, π, n), types of electronic transitions: σ-σ*, n-σ*, n-л*, л-л* with suitable examples. Selection rules, Terminology of chromophore, auxochrome, bathochromic and hypsochromic shifts. Absorption of characteristics of chromophores: diene, enone and aromatic chromophores. Representation of UV-visible spectra. General features of absorption – spectroscopy, transmittance, absorbance, and molar absorptivity. 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 **15h (1h/week)**

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

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, representation of proton NMR spectrum – Integrations. ^{1}H NMR spectrum of – ethyl bromide, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate and acetophenone.

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). Determination of molecular formula. Mass spectrum of ethyl chloride, ethyl bromide and acetophenone.

Unit III: Separation techniques - I **15h (1h/week)**

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

Thin layer Chromatography (TLC): Advantages, preparation of plates, Solid phase and mobile phase used in TLC, eluotopic series, development of the chromatogram, Detection of the spots, visualizing agents, factors effecting Rf values and applications of TLC.

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 **15h (1h/week)**

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, cation and anion exchange resins, its application in separation of ions, de-ionized water.

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.

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B.Sc. Chemistry III Year
Semester-V, Paper- V
Discipline Centric Elective-B (4 Credits)
Metallurgy, Dyes, Batteries and Nanomaterials **60 Hours**

Unit I: General Principles of Metallurgy and Production of Non Ferrous Metals 15h (1h/week)

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 **15h (1h/week)**

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, Fluorocein, 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: Batteries **15h (1h/week)**

S5-E-B-III: Batteries: Battery parameters. Energy density power density and Ragone plot. Measures of battery performance. Primary and secondary batteries. Zn/MnO2, lead-acid and Ni-Cd batteries and lithium-ion battery. Fuel cells: General Chemistry of Fuel cells. Types of fuel cells: H2/O2 and methanol/O2 fuel cells.

Use of porous electrodes in fuel cells. Advantages, limitations and efficiency of fuel cells.

Photovoltaic cells: Semiconductor based photoelectrochemical cells. Electrochemical energy from solar energy.

Unit IV Nanomaterials **15h (1h/week)**

S5-E-B-IV: 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).

Nanomaterials: Introduction to nanomaterials. Reduced dimensionality in solids – zero dimensional systems, fullerenes, quantum dots. One dimensional systems, carbon nano tubes, preparation of nano particles –top down and bottom up methods.

Preparation of nanomaterials – sol gel methods, and chemical vapor deposition method; thermolysis.

Properties: Carbon nano materials – Graphite, Fullerenes, Carbon nanotubes-structural, mechanical and electrical properties. Applications of nano-materials.

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12. Glasstone, S. Introduction to electrochemistry. East-West Press Pvt. Ltd.
13. Sharma, B. K. Electrochemistry. Krishna Prakashan Media.
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17. Ahluwalia, V. K., Dhingra, S., & Gulati, A. Practical chemistry. Universities Press.

B.Sc. Chemistry III Year
Semester - V, Paper-V
Laboratory Course-V
Experiments in Physical Chemistry-I

Paper V (Physical Chemistry) **30h (2h / week)**

1. Distribution law

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

2. Electrochemistry

a) Determination of cell constant of a conductivity cell.
b) Verification of Ostwald's dilution law- Determination of dissociation constant (K_a) of acetic acid by conductivity measurements.

3. Colorimetry

Verification of Beer's law using $KMnO_4$ -Determination of the concentration of the given solution.

4. Adsorption

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)

6. AI application in Chemistry

Hands-on demo using tools like MolView, DeepChem (Google Colab), or IBM RXN

References

1. Khosla, B. D., Garg, V. C., & Gulati, A. (2020). Senior practical physical chem. R. Chand & Co.
2. Viswanathan, B., & Raghavan, P. S. Practical physical chemistry. Viva Books.
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6. Neelam S. A (2021). A Comprehensive Guide to Physical chemistry experiments and viva questions, Vidyarthi Books, Notionpress.com.
7. Web tools: IBM RXN for Chemistry – AI-based reaction prediction tool
   Link: https://rxn.app.accelerate.science
8. ACD/Labs ChemSketch (Freeware) – Draw molecules, get properties, IUPAC names Link: https://www.acdlabs.com/resources/free-chemistry-software-apps/chemsketch-freeware
9. MoleculeNet (AI-ready datasets for chemical properties) Website: https://moleculenet.org
10. ChemRxiv (Chemistry Preprint Server) Website: https://chemrxiv.org
11. ChatGPT (AI chatbot for Q&A and explanations) Website: https://chat.openai.com

B.Sc. III Year CHEMISTRY

Semester – V; Multidisciplinary Course (MDC 1) (4 Credits)
MDC Course for B.Sc. Non Chemistry/B.A/B.Com/BBA/BCA Students

Paper – I Chemistry - I: Foundations of Chemistry – Concepts and Applications

Unit-I (Inorganic Chemistry)
Title: Building Blocks of Materials and Life **15 h (1 h/week)**

S1-I-1: Foundations of Inorganic Chemistry
Modern periodic table – significance of periods and groups, s, p, d, f blocks. Atomic structure review: Bohr model, Quantum numbers, shapes of orbitals. Chemical bonding: ionic, covalent and coordinate bonds; VSEPR theory basics. Periodic trends: Atomic radius, Ionization energy, Electron affinity, Electronegativity – importance in reactivity. Real-world applications: Examples of chemical bonding in - Ca–EDTA and Mg–EDTA complexes (coordination bonding) for water softening, Li^+ ion coordination and ionic interactions in lithium-ion batteries, and chelated micronutrient complexes such as Fe–EDTA in fertilizers.

S1-I-2: Everyday Inorganic Compounds
Chemistry of essential elements – sodium, calcium, iron, and iodine: physiological and environmental relevance. Introduction to acid–base concepts: Arrhenius, Brønsted–Lowry, and Lewis definitions. Industrial applications – cement chemistry (hydration reactions of calcium silicates), water softening (ion exchange resins and zeolites in bulk-water softening, mention of chelating agents like EDTA in analytical and industrial formulations), and soaps and detergents (saponification and surfactant action).

Unit - II (Organic Chemistry)
Title: Organic Chemistry in Life and Industry **15h (1 h/week)**

S1-O-1: Fundamentals of Organic Chemistry
Classification, Nomenclature, Functional groups and Isomerism of organic compounds with one example

S1-O-2: Organic Molecules in Everyday Life
Organic compounds in food: carbohydrates, proteins, fats. Pharmaceuticals: aspirin, paracetamol, antibiotics. Cosmetics and fragrances: alcohols, esters, and essential oils. Use of organic molecules in household products.

S1-O-3: Organic Chemistry in Industry

Petrochemicals and polymers: plastics, synthetic fibres, rubber (nylon, Teflon). Dyes: natural (indigo) vs. synthetic (azo dyes); basic dye chemistry. Organic solvents: toxicity, cleaning agents, Agrochemicals: classification of pesticides & fertilizers. Bhopal disaster, microplastic pollution.

Unit – III (Physical Chemistry)

Title : Matter, Energy & the Chemical World **15h (1 h/week)**

S1-P-1: Matter and Energy

States of matter and intermolecular forces. Gas laws – Boyle's law, Charles's law, and the Ideal Gas Law. Applications of gas laws: expansion of weather balloons with altitude (Charles's law, Ideal Gas Law) and breathing mechanism in humans (Boyle's law).

S1-P-2: Thermodynamics and Equilibrium

Concepts of heat, work, internal energy. Enthalpy and entropy (introductory level). Chemical equilibrium – Le Chatelier's principle with cooking (ex. Baking with yeast) and digestion (acid-base neutralization in stomach) as examples.

S1-P-3: Basics of Chemical Kinetics

Rate of reaction, factors affecting rate. Introduction to reaction order. Activation energy. Ex: fireworks (rapid combustion) and cooking (thermal breakdown of food molecules).

Unit - IV (General Chemistry)

Title : Chemistry in Context – Applications & Innovations **15 h (1 h/week)**

S1-G-1: Introduction to Analytical Chemistry

Measurement concepts: precision, accuracy. Volumetric analysis: titration basics – acid-base and redox titrations. Indicators and endpoint detection.

S1-G-2: Chemistry and Life

Chemistry in food: Preservatives, acidity regulators, emulsifiers. Introduction to Lipids & Vitamins (A,B,C,D,E,K) their importance.

S1-G-3: Modern Chemical Applications

Green chemistry principles – with examples such as enzyme catalysis and microwave-assisted synthesis. Nanochemistry – introduction and relevance with examples like silver nanoparticles and TiO_2 in sunscreens. Interdisciplinary chemistry – applications in agriculture (urea fertilizers), energy (Li-ion batteries), and the environment (water purification and CO_2 capture).

References

Unit- I

1. Puri, B. R., Sharma, L. R., & Kalia, M. S. (1996). Principles of Inorganic Chemistry. Vishal Publications.
2. Lee, J. D. (1981). Concise Inorganic Chemistry (3rd ed.). Oxford University Press.
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4. Shriver, D. F., & Atkins, P. W. (1999). Inorganic Chemistry (3rd ed.). Oxford University Press.

Unit- II

1. Basic Chemistry for Life Science Students and Professionals: Introduction to Organic Compounds and Drug Molecules – Solomon Habtemariam. Royal Society of Chemistry, 2023.
2. Organic Chemistry as a Second Language: First Semester Topics – David R. Klein, 5th ed., Wiley, 2015.
3. Morrison, R. T., & Boyd, R. N. (2011). Organic Chemistry. Pearson.
4. Solomons, T. W. G., & Fryhle, C. B. (2016). Organic Chemistry. Wiley.
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Unit III

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2. Atkins, P. W., & De Paula, J. (2010). Atkins' Physical Chemistry (9th ed.). Oxford University Press.
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4. Kalidas, C., & Sangaranarayanan, M. V. (2019). Physical Chemistry: Problems and Solutions. Universities Press.

Unit IV

1. Vogel, A. I. (2000). Textbook of Quantitative Chemical Analysis (6th ed.). Pearson Education.
2. Day, R. A., & Underwood, A. L. (2004). Quantitative Analysis (6th ed.). Prentice Hall.
3. Satake, M., Hayashi, Y., Mido, Y., Iqbal, S. A., & Sethi, M. S. (2014). Colloidal and Surface Chemistry. Discovery Publishing.
4. Pillai, S. O. (2008). Chemistry in Everyday Life. Universities Press.
5. Rathi, R. K., & Rathi, R. (2014). Essentials of Physical Chemistry. CBS Publishers.
6. Jain, M. K., & Sharma, S. C. (2014). Modern Chemistry. Vishal Publishing Co.
7. Pahari, P. (2020). A Textbook of Green Chemistry. New Central Book Agency.
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B.Sc. III Year Chemistry

Semester-V

Skill Enhancement Course- I (SEC-I) (2 Credits)

Rules in Chemistry Laboratory and Lab Reagents

Unit I: Laboratory Safety Rules and Regulations **15h (1h/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 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 **15h (1 h/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 ammoniacal 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 $FeCl_3$, 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.

References

1. Jeffery, G. H., Bassett, J., Mendham, J., & Denney, R. C. (1989). Vogel's textbook of quantitative chemical analysis (5th ed.). Longman Scientific & Technical.
2. Svehla, G. (1987). Vogel's textbook of macro and semimicro qualitative inorganic analysis (5th ed.). Longman.
3. Department of Chemistry, SGTB Khalsa College. Chemistry reagent manual. University of Delhi, DBT Star College Scheme. Retrieved April 12, 2025, from https://www.sgtbkhalsadu.ac.in/wp-content/uploads/2020/07/Reagent_Manual.pdf
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B.Sc. III Year Chemistry

Semester V

Skill Enhancement Course- II (SEC –II) (2 Credits)

Effects of pollution & control of water Pollution, Drinking Water Treatment and Soil Analysis

UNIT I: Detrimental effects of pollution & control of water and Soil Pollution

15h (1h/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 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 Treatment and Soil Analysis

15h (1h/week)

Water Quality and Common Treatments of Drinking Water:

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.

Soil Chemistry and Analysis - 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 forms and interaction with farmers. Discussion with farmers on the use of Soil Analysis Kits.

References

1. Ravi, M., Srinivas, G., Reddy, P. V., Kumar, V. R., & Ushaiah, B. A textbook for remedial methods for pollution, drinking water, and soil fertility standards (1st ed.). ISBN 978-93-5311-183-0.
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3. Yogi Babu, N., Vanjatha, G., & Srilatha, M. Remedial methods for pollution, drinking water, and soil fertility standards [Telugu version].
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12. Burrell, L. Cell phone radiation protection – highly effective tips. Electric Sense. Retrieved from https://www.electricsense.com/775/how-to-protect-yourself-from-cell-phone-radiation/
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14. Clean Air Gardening. Trees and your environment. https://www.cleanairgardening.com/plantingtrees
15. University of Georgia Extension. Water quality and common treatments for private drinking water. Retrieved from https://extension.uga.edu/publications/detail.html?number=b939
16. Center for Agroecology and Sustainable Food Systems. Soil chemistry. University of California Santa Cruz. Retrieved from https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDFdownloads/2.2-soil-chemistry.pdf
17. Amrita Virtual Labs. Soil analysis – determination of available nitrogen. Retrieved from https://vlab.amrita.edu/?sub=2&brch=294&sim=1551&cnt=1
18. Centurion University. Determination of dissolved oxygen (DO). Retrieved from https://www.cutm.ac.in/pdf/env%20engg%20lab%20manual.pdf
19. Pharma Guideline. Determination of chemical oxygen demand of wastewater. Retrieved from https://www.pharmaguideline.com/quality-control/test.

B.Sc. Chemistry III Year
Semester-VI, Paper-VI
Discipline Centric Elective-A (4 Credits)
A. Medicinal Chemistry **60 Hours**

Unit- I: Introduction and Terminology **15h (1h/week)**

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

Terminology in Medicinal Chemistry: Drug, Pharmacology, Pharmacophore, Pharmacodynamics, Pharmacokinetics, metabolites, anti metabolites and therapeutic index.

Drugs: Nomenclature: Chemical name, Generic name and Trade names with examples; Classification: Classification based on structures and therapeutic activity with examples.

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

Unit-II: Enzymes and Receptors **15h (1h/week)**

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

Receptors: Introduction, Drug action-receptor theory, Mechanism of drug action, concept of agonists and antagonists with examples. Drug receptor interactions involved in drug receptor complex. binding role of –OH group, $-NH_2$ group

Unit- III: Synthesis and Therapeutic Activity of Drugs **15h (1h/week)**

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

Chemotherapeutics: Sulphanilamide, dapsone, Isoniazid and Cisplatin.

Drugs to treat metabolic disorders: Anti diabetic - Tolbutamide; Anti-inflammatory – Ibuprofen; Cardiovascular- Glyceryl trinitrate.

Drugs acting on nervous system: Anesthetics-definition, Classification-local and general. Volatile-Nitrous oxide, Local anaesthetics – benzocaine.

Unit- IV: Molecular Messengers, their synthesis and Health Promoting Drugs **15h (1h/week)**

S6-E-A-IV: Molecular Messengers: Introduction to hormones and neurotransmitters, Thyroid hormones, one synthetic method for the following drugs.

1). Antithyroid drug-Carbimazol.
2).Adrenergic drugs- Salbutamol.
3). Selective Serotonin Reuptake Inhibitors (SSRIs)- Fluoxetine.
4). Antiparkinson drug- Levodopa.

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

References

1. Patrick, G. L. (2013). Introduction to medicinal chemistry. Oxford University Press.
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3. Williams, D. A., & Lemke, T. L. (2008). Foye's principles of medicinal chemistry. Lippincott Williams & Wilkins.
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B.Sc. Chemistry III Year
Semester –VI, Paper-VI
Discipline Centric Elective-B (4 Credits)
B. Agricultural and Fuel Chemistry **60 Hours**

Unit I: Agricultural Chemistry I **15h (1h/week)**

S6-E-B-I: Pesticides

Introduction: Definition, classification of pesticides based on use (target). Toxicity and chemical structure with examples. Adverse effects of pesticides and its impact on environmental pollution. Synthesis, technical manufacture and uses of representative pesticides in the following classes: Organochlorines (Cypermethrin); Organophosphates (Parathion); Carbamates (carbaryl); Quinones (Chloranil), Anilides (Alachlor).

Pesticide formulations: Dusts, Granules, Wettable powders, Emulsions and Aerosols.

Biopesticides : Introduction: Potential pesticidal plants of India, Role of Neem in plant protection-constituents, Azadirachtin and its role in pest control, Structure and mode of action of Pyrethrins(pyrethrin-1) and Pyrethroids (permethrin) and nicotinoids (Imidacloprid).

Unit II: – Agricultural Chemistry II **15h (1h/week)**

S6-E-B-II: Fertilizers

Introduction (need of fertilizers), functions of essential plant nutrients (N, P, K), Classification formula and uses of fertilizers:

Nitrogenous fertilizers: Ammonium nitrate, Urea, Calcium Cyanamide, Calcium Ammonium Nitrate, Sodium Nitrate, Ammonium Chloride and their uses.

Phosphate fertilizers: Normal super phosphate, Triple Super Phosphate, Ammonium Phosphate and their uses.

Potassium fertilizers: Potassium chloride, potassium nitrate, potassium sulphate and uses. Complex fertilizers: Diammonium Phosphate and mixed fertilizers their uses. Manufacture of urea and Super phosphate of lime and their reactions in the soil.

Biofertilizers – Introduction, definition, classification, Rhizobium, Azatobactor, Azospirillium, Azolla, Blue Green Algae, Vermicomposting and uses.

Organic farming: The principal methods, crop rotation, green manures and compost, biological pest control, and mechanical cultivation and uses.

Unit III: Fuel Chemistry I **15h (1h/week)**

S6-E-B-III: Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

Unit IV: Fuel Chemistry II **15h (1h/week)**

S6-E-B-IV: Petroleum : Composition of crude petroleum, Refining and different types of petroleum products and their applications.

Fractional Distillation - Principle and process, Cracking -Thermal and catalytic cracking, Reforming of Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.

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.

References

1. Melnikov, N. N. (2012). Chemistry of pesticides. Springer-Verlag.
2. Unger, T. A. (2000). Pesticide synthesis handbook. Elsevier.
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B.Sc. Chemistry III Year
Semester - VI
Laboratory course-VI
Paper VI (Physical Chemistry)

Experiments in Physical Chemistry-II **30h (2h/week)**

1. Kinetics

a) Determination of specific reaction rate of the hydrolysis of methyl acetate catalyzed by hydrogen ion at room temperature.
b) Determination of rate of decomposition of hydrogen peroxide catalyzed by $FeCl_3$.

2. Electrochemistry

A. Potentiometry:

a) Determination of redox potential of Fe^{2+}/Fe^{3+} by potentiometric titration of ferrous ammonium sulphate vs. potassium dichromate.
b) Precipitation titration of KCl vs. $AgNO_3$ -Determination of given concentration of silver nitrate.

B. pH metry:

a) pH metric titration of strong acid (HCl) vs. strong base- Determination of the concentration of the given acid.
b) pH metric titration of weak acid(acetic acid) with strong base(NaOH) - Determination of acid dissociation constant (K_a) of weak acid.

3. Conductometry:

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

References

1. Khosla, B. D., Garg, V. C., & Gulati, A. (2011). Senior practical physical chemistry. R. Chand & Co.
2. Athawale, V. D., & Mathur, P. (2011). Experimental physical chemistry. New Age International.
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6. Neelam S. A (2021). A Comprehensive Guide to Physical chemistry experiments and viva questions, Vidyarthi Books, Notionpress.com.

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

Unit – I: Types of Materials **15h (1h/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 example: MgO, and special refractories examples: 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 **15h (1h/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. Callister, W. D. (2006). Materials science and Engg.: An introduction. John Wiley & Sons, Inc.
2. Kakani, S. L., & Kakani, A. Material science. New Age International Publishers.
3. Bhat, S. V. (2002). Biomaterials. Narosa Publishing House.
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5. Duerig, T. W., Melton, K. N., Stöckel, D., & Wayman, C. M. (1990). Engineering aspects of shape memory alloys. Butterworth–Heinemann.
6. Chandrasekhar, P. (2003). Conducting polymers: Fundamentals and applications – A practical approach. Kluwer Academic Publishers.

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

Unit-I: Chemistry of Cosmetics and Perfumes **15h (1h/week)**

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 flavors. 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 Sulfide.

Unit-II: Food Processing and Food Adulteration **15h (1h/week)**

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. Stocchi, E. Industrial chemistry (Vol. 1). Ellis Horwood Ltd.
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3. Sharma, B. K., & Gaur, H. (1996). Industrial chemistry. Goel Publishing House.
4. Devi, R. (2015). Food processing and impact on nutrition. Scientific Journal of Agriculture and Veterinary Sciences, 2(4A), 304–311.
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8. Ranganna, S. (1986). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill Education.
9. Ghosh, J. C. Fundamental concepts of applied chemistry. S. Chand & Co. Ltd.
10. Sundhar, K. B. Applied chemistry. MJP Publishers.

B.Sc. CBCS CHEMISTRY

Theory Model Question Paper
For
Semester I, II, III, IV, V, VI

Time: 3 Hours **Max. Marks: 80**

Part-A **(8 x 4 = 32 Marks)**

(Short Answer Type)

I. Write any eight (8) 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

13 a)
OR
b)
14 a)
OR
b)
15 a)
OR
b)
16 a)
OR
b)

B.Sc. CBCS CHEMISTRY

Practical Model Question Paper

For

Semester I, II, III, IV, V, VI

Time: 3 Hours **Max. Marks: 50**

SEMESTER	External (Marks)	Internal (Marks)	Total (Marks)
I	40	10	50
II	40	10	50
III	40	10	50
IV	40	10	50
V	40	10	50
VI	40	10	50

**********The End**********