

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

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**B.Sc. I YEAR CHEMISTRY
SEMESTER WISE SYLLABUS
SEMESTER I**

**Paper – I
Chemistry–I**

**IE - 40Marks
SEE - 60Marks**

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

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

15h

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) suboxide (d) peroxide (e) superoxide. Structure of oxides and oxy acids 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.

Unit-II (Organic Chemistry)

15h (1h/week)

S1-O-1:Structural Theory in Organic Chemistry

5h

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 carboniumions, free radicals and alkenes.

S1-O-2:Acyclic Hydrocarbons

5h

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) dehydro halogenation of alkyl halides (c) by de halogenation 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 dehydro halogenation of vicinal dihalides, de halogenation 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 Hydro carbons

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, photo electric 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: Photo chemistry

4h

Introduction to photo chemistry – 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.

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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 diphenyl amine 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 Stereo isomers - definition and examples. Constitutional isomers: chain, functional and positional isomers. Stereo isomers: enantiomers and diastereomers – definitions and examples. Representation of stereo isomers – Wedge, Fischer, Sawhorse, Newmann projection formulae.

Conformational analysis: Classification of stereo isomers 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 (3rded.). Oxford University Press.
3. Cotton, F. A., Wilkinson, G., & Gaus, P. L. (2001). Basic inorganic chemistry (3rded.). Wiley.
4. Huheey, J. E., Keiter, E. A., & Keiter, R. L. (1993). Inorganic chemistry: Principles of structure and reactivity (4thed.). 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 (3rded.). 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).
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).
7. Soni, P. L., & Soni, H. M. (2012). Organic chemistry. Sultan Chand & Sons.
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 (46thed.). Vishal Publishing Company.
2. Raj, G. (2009). Advanced physical chemistry (35thed.). Goel Publishing House.
3. Lewis, G., & Glasstone, S. (1966). Elements of physical chemistry. Macmillan.
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6. Laidler, K. J. (1987). Chemical kinetics (3rded.). 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.
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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 (5thed.). Addison Wesley Longman Inc.
2. Day, R. A., & Underwood, A. L. (2004). Quantitative analysis (6thed.). Prentice Hall of India.
3. Svehla, G. (1996). Vogel's qualitative inorganic analysis (7thed.). 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.
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8. Levine, I. N. (2009). Physical chemistry (6thed.). 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 (9thed.). 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.


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Laboratory Course-I

30h(2h/ week)

Paper-I: Quantitative Analysis

50 Marks

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 (5thed.). Addison Wesley Longman Inc.
2. Vogel, A. I. Vogel's Textbook of Quantitative Chemical Analysis, 6th Edition, Pearson Education, 2000. ISBN: 9780582226289
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7. 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 I YEAR CHEMISTRY
SEMESTERWISE SYLLABUS
SEMESTER II
Paper – II
Chemistry–II

IE - 40Marks
SEE - 60Marks

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 benzenesulphonic acids.

Properties: Acidic nature, formation of phenoxide and reaction with R-X , electrophilic substitution; halogenations, Reimer 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 .



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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:Electro chemistry

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, anti bonding and non-bonding. MOED of homo nuclear diatomic molecules - H_2 , N_2 , O_2 , O_2^- , O_2^{2-} , F_2 (un hybridized diagrams only) and hetero nuclear diatomics - CO , CN^- , NO , NO^+ and HF , their bond order, stability and magnetic properties.

S2-G-2:Stereo isomerism

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 (2,3-dibromopentane). 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.

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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 (3rded.). Oxford University Press.
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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 (46thed.). Vishal Publishing Company.
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Laboratory Course - II

30h(2h/ week)

50 Marks

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 (7thed.). Prentice Hall.
2. Gopalan, R., Subramanian, P. S., & Raghavan, K. (2004). Elements of analytical chemistry. Sultan Chand & Sons.
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5. Sharma, R. K. (2013). Experiments and techniques in inorganic chemistry. Krishna Prakashan Media.
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