

Department of Chemistry
EWING CHRISTIAN COLLEGE
ALLAHABAD
(An Autonomous Constituent College of University of Allahabad)

B.SC. SEMESTER-I: CHEMISTRY
THEORY PAPER: I
TITLE: INORGANIC CHEMISTRY

Time

Assessment Exam: 45 Mts
End Semester Exam: 3 Hrs

Marks

Assessment:10
End Semester:60
Total:70

1. A) ATOMIC STRUCTURE:

Bohr's and sommerfield atomic models, Applications including absorption Emission spectra, Rydberg's equation and its applications, spectral series and its limit, Dual behavior of matter and radiation, de-Broglie's relationship, Heisenberg's uncertainty principle, Concept of orbitals

B) QUANTUM NUMBERS:

Definition, types, determination and significance, shapes of s, p, d and f orbitals, nodes and nodal planes, orientation of s-, p-, and d- atomic orbitals.

C) ELECTRONIC CONFIGURATION

Definition, Rules of filling electrons in various orbitals: Pauli Exclusion principle, Aufbau principle and Hund's rule of maximum multiplicity, their significance, stability of half and fully filled orbitals, exchange energy, Relative energies of various atomic orbitals, Anamalous electronic configurations.

2. PERIODIC CLASSIFICATION OF ELEMENTS:

Periodic law, Periodicity with respect to electronic configuration of elements. General description of long form of periodic table including electronic configuration of s, p, d and f blocks and characteristics. Significance and limitations of the periodic Table.

3. PERIODIC PROPERTIES

Atomic and Ionic radii, Ionization potential (IP), Electron Affinity (EA) and Electronegativity (EN): Concept, determination, factors effecting, trend in modern periodic table and significance.

4. QUALITATIVE ANALYSIS

Principles and chemical reactions involved in qualitative analysis of Inorganic mixture and problems based on mixture analysis including identification and tests of cations and anions.

B.SC. SEMESTER-I: CHEMISTRY
THEORY PAPER: II
TITLE: ORGANIC CHEMISTRY

1. STRUCTURE AND BONDING:

Hybridization, bond length, bond angles and bond energy.

Localized and delocalized chemical bond: Inductive effect, electromeric effect, Mesomeric effect and Hyperconjugation.

2. MECHANISM OF ORGANIC REACTIONS

Bond Fission with special reference to Homolysis and Heterolysis

Reactive Intermediates: Formation, stability and stabilization of Carboniums, Carbanions and free radicals.

3. HYDROCARBONS

Alkanes: Methods of formation with special reference to Wurtz reaction, Kolbe's reaction, Corey-House synthesis and Decarboxylation of Carboxylic acids. Chemical reactions of alkanes with special reference to Halogenation, cracking, Aromatization and isomerization.

Alkenes: Methods of formation with special reference to dehydration of alcohols, Dehydrohalogenation of alkyl halides (E-1 and E-2). Comparative stabilities of Alkenes. Chemical reactions of Alkenes with special reference to Electrophilic and free radical reactions which include Markownikov and anti Markownikov addition reactions. Hydration, Hydroboration-Oxidation, hydroxylation, KMnO₄ oxidation, Epoxidation and Ozonolysis. Allylic Substitution and Mustard gas formation.

Dienes: Methods of formation, stability of conjugated Dienes, Chemical reactions of Dienes with special reference to Electrophilic addition (Kinetically and Thermodynamically stable products) Diel's Alder reaction and retro Diel's Alder process to identify Dienes and Dienophile structures.

Alkynes: Methods of formation, Chemical reaction with special reference to Electrophilic and nucleophilic reactions, acidity of alkynes, Hydroation and Hydroboration (oxidation and reduction), polymerization and ozonolysis reactions.

4. AROMATIC HYDROCARBONS

Structure of benzene; molecular formula and Kekule structure, Stability and carbon-carbon bond length of benzene, resonance structure, MO picture. Aromaticity; the Huckel rule applied to compounds and aromatic ions. Directive influence. Identification of di-substituted benzene derivatives by Korner's absolute method and dipole moment studies chemical reactions of benzene ; aromatic electrophilic substitution-general patterns of the mechanism, role of σ and π complexes. Mechanism of nitration halogenations, sulphonation, oxidation, Friedel-Crafts reaction (Alkylation and Acylation) Birch reduction, methods of formation and chemical reactions of Toluene.

5. MONO-HALOGEN COMPOUNDS

Alkyl halides-method of formation, chemical reactions, mechanism of nucleophilic substitution reactions (S_N2 and S_N1) and their effect on optically active alkyl halides with energy profile diagram. Comparative reactivities of alkyl, allyl, vinyl and aryl halides towards nucleophilic substitution reactions. Aryl halides-halides-the addition-elimination and the elimination-addition reaction of nucleophilic aromatic substitution reactions.

B.SC. SEMESTER-I: CHEMISTRY
CHEMISTRY PRACTICALS

Duration: 4 ½ Hrs

Marks: 50

WORKING IN CHEMISTRY LABORATORY:

Introduction: -Personal protectin and precautions to be taken during working in chemical laboratory. Philosophy of Lab safety. Nature of chemicals-toxic, corrosive, explosive, inflammable, carcinogenic and other hazardous chemicals: Instructions for safe storing and handling of chemicals, disposal of chemical wastes, handling of various types of glasswares and other apparatuses, handling of different types of equipment viz Bunsen burner, concept of centrifugation machine, Kipps apparatus, etc.

A. INORGANIC CHEMISTRY

1. General principles of Qualitative analysis

Theory of testing acid radicals-simple and interfering, principle of grouping of cations, theory of testing cations, concept of solubility and solubility product, common ion effect, principle of flame testing.

2. Semi-micro Qualitative Inorganic mixture analysis

- a. Principles of semi-micro analysis
- b. Analysis of simple acid radicals-carbonates, sulphide, sulphate, chloride, bromide, iodide, nitrate, nitrite
- c. Combination of acid radicals-Nitrate-nitrite, Nitrate-Bromide, Nitrate-Iodide, Sulphide-Sulphite-Sulphate, Chloride-Bromide-Iodide, Carbonate-Sulphite
- d. Analysis of interfering radicals viz. Fluoride, Oxalate, Borate, Phosphate.
- e. Elimination of interfering acid and identifying the groups of basic radicals.
- f. Group wise analysis of basic radicals-Lead, Copper, Bismuth, Arsenic, Tin, Cadmium, Antimony, Aluminium, Iron, Chromium, Zinc, Manganese, Nickel, Calcium, Strontium, Barium, Magnesium, Ammonium.
- g. Analysis of acid insoluble substances-Lead sulphate, Calcium Fluoride, Aluminium oxide, Barium sulphate, Calcium Sulphate, Strontium Sulphate.
- h. Analysis of unknown Inorganic mixtures containing cations and anions (Total five)

B. VIVA VOCE

C. PRACTICAL RECORDS

B.SC. SEMESTER-II: CHEMISTRY
THEORY PAPER: I
TITLE: PHYSICAL CHEMISTRY

1. REAL GASES

van der Waal's equation, critical constants.
Principles of corresponding states
Qualitative treatment of Maxwell Law of distribution of velocities.

2. CHEMICAL EQUILIBRIUM

Law of mass action, Significance of equilibrium constant, Relation between K_p and K_c .
Applications in homogeneous and heterogeneous equilibria. Effect of pressure, Temperature, Concentration and Inert substances on the state equilibrium and Le Chatliers principles.

3. IONIC EQUILIBRIUM

Buffer solution and its pH, Hydrolysis of salts, Acid, Base indicators, Ostwald and Quinonoid theories, Solubility product.

4. THERMODYNAMICS

Thermodynamic terms, statement of law, Thermodynamic reversibility and maximum work state function and exact differential, Cyclic rule, Integration factor, Variation of E with temperature and volume and H as function of temperature and pressure, Joule Thomson experiment and μ_J .

Thermochemistry: Heat of reaction at constant pressure and constant volume, Heat of combustion, Formation and neutralization, Hess's law, Kirchoff's equation, Bond energy, Resonance energy.

B.SC. SEMESTER-II: CHEMISTRY
THEORY PAPER: II
TITLE: INORGANIC CHEMISTRY

1. CHEMICAL BONDING-I

Ionic bonding, Lattice energy, Hydration energy, Born Haber cycle, Solubility of ionic compounds, Covalent bonding, σ and π bonds, Partial covalent character in an ionic bond, Fajan's rule, Coordinate bonding, Metallic bonding, Hydrogen bonding.

2. CHEMICAL BONDING –II

Shape and orientation of orbitals, Directional nature of covalent bond, Sidgwick Powell theory, Valence Shell Electron Pair Repulsion (VSEPR) theory, Effect of lone pair/lone pairs, Electronegativity and size of atoms on the geometry of covalent molecules and ions, limitations, Shapes of inorganic molecules and ions having bond pairs and lone pairs such as BeCl_2 , BF_3 , CCl_4 , PCl_3 , NH_3 , H_2O , OF_2 , I_3^+ , PCl_5 , SF_4 , I_3^- , ICl_3 , IF_7 , Concept of hybridization and its applications in determination of geometry of covalent molecules and ions.

3. ELECTRODE POTENTIAL

Electrode potential, Standard electrode potential, Electrochemical series and its applications, Redox potential diagrams and their applications.

4. CHEMISTRY OF s-BLOCK AND GROUP 18 ELEMENTS

a. Hydrogen: Ortho and Para Hydrogen, Isotopes of Hydrogen

b. I A and II A Groups: Electronic configuration, Position in periodic table, Physical properties, Storage, Bonding, Chemical reactions with air, water, acids and bases, Chemical compounds - Hydrides, Halides, Oxides, Carbonates, Bicarbonates, Solution in Ammonia.

c. Inert gases: Electronic configuration, Position in periodic table, Inertness, Properties and some important types of chemical compounds, Isolation and separation from air.

5. VOLUMETRIC ANALYSIS

General principles, Kinds of volumetric analysis, significances, Determination and strength of a chemical substance in a solution, Concept of equivalent weight, Normality, Molarity, Molality, Mole concept etc. Complexometric titrations with special reference to EDTA titrations.

CHEMISTRY PRACTICALS

Duration: 4 ½ Hrs

Marks: 50

A. INORGANIC CHEMISTRY

1. Calibration of fractional weights, pipettes and burettes
2. Preparation of standard solutions of different concentrations and their dilutions (N/10, N/100, N/1000)
3. Volumetric analysis
 - a. General principles of Titrimetry (Volumetric analysis)
 - b. Estimation of water of crystallization of Mohr's salt by titrating it with Potassium permanganate.
 - c. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
 - d. Determination of strength of a given solution by double titration
 - Estimation of $K_2Cr_2O_7$ by standard $K_2Cr_2O_7$ solution using N-phenyl anthranilic acid as internal indicator.
 - Estimation of $K_2Cr_2O_7$ by standard $K_2Cr_2O_7$ solution using Potassium Ferricyanide as external indicator.
 - Estimation of Copper sulphate solution by Iodometric method.
 - Estimation of $K_2Cr_2O_7$ solution by Iodometric method.

B. VIVA VOCE

C. PRACTICAL RECORDS

BOOKS RECOMMENDED FOR SEMESTER I AND II

INORGANIC CHEMISTRY

1. J. D. Lee: A New Concise Inorganic Chemistry, ELBS Ed.
2. F.A. Cotton and G. Wilkinson: Basic Inorganic Chemistry, John-Wiley Publications
3. B.R. Puri and L.R. Sharma and K.C. Kalia: Principles of Inorganic Chemistry Milestone publishers.
4. G.S. Manku : Theoretical Principles of Inorganic Chemistry, TATA-McGraw Hil
5. Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch: Fundamentals of Analytical Chemistry, 9th edition, Cengage Learning India Pvt. Ltd.
6. P.J. Durrant, B. Durrant: Introduction to Advanced Inorganic chemistry, ELBS
7. R. Sarkar : General Inorganic Chemistry (Part I and II) , New Central Book Agency, Kolkata.

ORGANIC CHEMISTRY

1. Organic Chemistry- I.L. Finar (Vol I)
2. Organic Chemistry- L.G. Wade Jr.
3. Organic Chemistry- Paula Y. Bruce
4. Organic Chemistry- R.T. Morrison and R.N. Boyd

5. Organic Chemistry- M.K. Jain
6. Under graduate Organic Chemistry, J. Singh and L.D.S. Yadav (Vol I and Vol II)

PHYSICAL CHEMISTRY

1. Physical Chemistry- Puri and Sharma
2. Physical Chemistry- Bahl and Tuli
3. Physical Chemistry- R.P. Rastogi
4. Physical Chemistry- Negi and Anand
5. Physical Chemistry-P.C. Rakshit
6. Physical Chemistry- R.C. Mukherjee (Chemical Calculations)

PRACTICALS

1. A. I. Vogel: Vogel's Qualitative Inorganic Analysis-Printice Hall: 7th edition
2. A. I. Vogel: Vogel's Quantitative Chemical Analysis-Printice Hall: 6th edition
3. A. I. Vogel: Vogel's Text book of Practical Organic Chemistry-Printice Hall: 5th edition

B. Sc. SEMESTER - III

Theory Paper –I

[Title: Organic Chemistry]

Duration:

Internal Assessment : 45 Minutes

End Semester Exam. : 3 Hours

Marks

Theory Paper : 60

Internal : 10

Grand Total : 70

1. MONOHYDRIC COMPOUNDS

Monohydric (primary secondary and tertiary alcohols): General methods of preparation, distinction of primary secondary and tertiary alcohols, chemical reactions with special reference to acidic character, esterification, reaction with Grignard reagent and phosphorous halides, oxidation and dehydration.

2. PHENOL

General methods of preparation, chemical reactions with special reference to acidic character, etherification, esterification, Riemer Tiemann reaction, Kolbe-Schmidth reaction, thalien reaction, oxidation and electrophilic substitution.

3. STEREOCHEMISTRY OF ORGANIC COMPOUNDS

Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centres, properties of enantiomers, compounds containing two stereogenic centres, concept of diastereomers, threo and erythro isomers, meso compounds, resolution, inversion, retention, racemisation.

Relative and absolute configuration, sequence rules, D/L and R/S system, nomenclature.

Geometric isomerism, elementary idea of cis and trans isomerism, determination of configuration, E/Z system of nomenclature and geometrical isomerism of oximes.

4. CARBONYL COMPOUNDS (ALIPHATIC AND AROMATIC ALDEHYDES AND KETONES)

General methods of preparation with special reference to synthesis from acid chlorides, 1, 3-dithianes, cyanides and carboxylic acids and Oppenauer oxidation. Properties with special reference to aldol condensation, cross aldol condensation, Perkin's reaction, Claisen – Schmidth reaction, Claisen condensation, Knoevenagel condensation, Benzoin condensation. Reaction with ammonia and alcohol. Wittig's reaction, Mannich's reaction, Bayer-Villiger's reaction, Cannizzaro's reaction, Tischenko's reaction, MPV reaction, halogenations of enolisable ketones and Michael's reaction.

5. ALIPHATIC AND AROMATIC CARBOXYLIC ACIDS

Synthesis of acids, strength of acids, effect of substituent on acid strength, and effect of substituent position on acid strength. An elementary idea of ortho effect. Reactions of carboxylic acids with special reference to HVZ reaction, synthesis of acid derivatives and mechanism of decarboxylation.

Halogen acids: Synthesis and reactions.

Hydroxy acids: Synthesis and reactions.

6. CARBOXYLIC ACID DERIVATIVES

Synthesis and properties of acid chlorides, acid anhydrides, esters and amides with special reference to mechanism of esterification, ester hydrolysis, Hofmann-Bromamide reaction. Comparative tendency to undergo nucleophilic substitution reactions.

B. Sc. SEMESTER - III

Theory Paper –II

[Title: Physical Chemistry]

Duration:

Internal Assessment : 45 Minutes

End Semester Exam. : 3 Hours

Marks

Theory Paper : 60

Internal : 10

Grand Total : 70

1. CHEMICAL KINETICS

Molecularity and Order of reaction, Rate law, Rate constants; Zero, first, second and third order reactions and their characteristics. Determination of order of reaction. Arrhenius equation and energy activation, Collision theory for bimolecular reactions, Lindemann theory for unimolecular reactions, Qualitative treatment of transition state theory.

2. PHASE RULE

Phase, Component and degree of freedom, Monocomponent system (water and sulphur), Bicomponent system (Ag +Pb).

3. THERMODYNAMICS

Carnot cycle, Statement of second law, Concept of Entropy, Combined form of first and second law of thermodynamics, Enthalpy and Entropy, Energy as a function of V and T, Enthalpy as a function of T and p, Entropy change in isolated system, Variation of entropy with temperature and volume, Entropy change in chemical reaction. Helmholtz and Gibbs free energies, Properties of Gibbs Helmholtz equation, thermodynamic criteria of equilibrium, Clapeyron- Clausius equation and its application.

4. ELECTRO CHEMISTRY

Reversible and irreversible cells, E.M.F. of Galvanic cells and free energy change, Nernst equation, Equilibrium constant, Standard electrode potential, Types of reversible electrode, concentration cells without transference, Application of E.M.F. measurements, Determination of solubility product, pH, Dissociation constants, Solubility of sparingly soluble salts.

B. Sc. SEMESTER - III
CHEMISTRY PARTICALS

Duration : 4 1/2 hours

Max Marks: 50

A. ORGANIC CHEMISTRY

- a. Preparation of Sodium extract for detection of elements in the given solid organic compound.
- b. Various confirmatory tests and chemical reactions involved in the detection of the following functional groups in the solid organic compound:
OH (aromatic and aliphatic), -NH₂ (Aromatic primary amine) CHO, Ketonic, thioamide, -COOH, -CONH₂, -NO₂ (Aromatic)
- c. Differentiation between reducing and non-reducing sugars.

B. PHYSICAL CHEMISTRY

- a. Determination of surface tension using Stalagmometer
 - (i) Principles of surface tension
 - (ii) Determination of surface tension of the given solution.
 - (iii) Determination of concentration (in %) of the given unknown solution.
- b. Determination of viscosity using Ostwald's viscometer
 - (i) Principles of viscosity
 - (ii) Determination of the relative viscosity of the given solution.
 - (iii) Determination of concentration (in %) of the given unknown solution.

C. VIVA VOCE

D. RECORDS

B. Sc. SEMESTER - IV

Theory Paper –I

[Title: Inorganic Chemistry]

Duration:

Internal Assessment : 45 Minutes

End Semester Exam. : 3 Hours

Marks

Theory Paper : 60

Internal : 10

Grand Total : 70

1. CHEMISTRY OF p-BLOCK ELEMENTS

a. Characteristic Properties: Electronic Configuration, position in periodic table, metallic and non-metallic properties, middle row anomaly, inert pair effect, oxidation states, oxidizing states, oxidizing behavior, bonding (sigma bonding, $p\pi - p\pi$ bonding and $p\pi - d\pi$ bonding)

b. General Group Discussion: Comparative group study and periodic trends in the light of hydrides, oxides and halides of B, Al, Ga, In, Tl; C, Si, Ge, Sn, Pb; N, P, As, Sb, Bi; O, S, Se, Te, F, Cl, Br, I (application of redox potential diagrams in reference to N, P, S and Cl).

2. GENERAL CHARACTERISTICS AND TRENDS OF d-BLOCK ELEMENTS

Electronic configuration: Position in Periodic Table, Transition Series.

General Characteristics: Variable oxidation states, complex formation, colour, magnetic properties, catalytic properties. Comparative accounts of 3d, 4d and 5d transition metals with respect to their atomic and ionic sizes, stability of oxidation states and magnetic properties.

3. CHEMISTRY OF COORDINATION COMPOUNDS

Complexes and double salts, Werner's theory, Sidgwick's theory, EAN, IUPAC nomenclature (chelate excluded), general idea of isomerism in coordination compounds (definition and some typical examples).

4. EXTRACTION OF ELEMENTS

General principles of extraction and metallurgy. Chemical principles involved in the extraction and isolation of following elements: B, F, Si, Ge, Cr, and Ni.

5. GRAVIMETRIC ANALYSIS

Principles, Super saturation, Co-precipitation, Post-precipitation, particle size, Precipitation – general procedure, ash treatment and numerical problems.

B. Sc. SEMESTER - IV

Theory Paper –II

[Title: Organic Chemistry]

Duration:

Internal Assessment : 45 Minutes

End Semester Exam. : 3 Hours

Marks

Theory Paper : 60

Internal : 10

Grand Total : 70

1. DI-HYDRIC AND TRI-HYDRIC ALCOHOLS

Di-hydric : Methods of formation, chemical reactions with special reference to HIO_4 cleavage and Pinacol – Pinacolone rearrangements.

Tri-hydric : Constitution of glycerol, its methods of formation, chemical reactions and oxidation.

2. ETHERS AND EPOXIDES

General study of methods of preparation and properties.

3. CYCLOALKANES

Methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

4. CONFORMATIONAL ISOMERISM

Conformational analysis of ethane, butane and cyclohexane, Axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives, Newmann projection formula and Fischer formula.

5. ALIPHATIC AND AROMATIC NITROGEN COMPOUNDS

Preparation and properties of nitroalkanes, nitroarenes with special reference to reduction in mediums of different pH, Preparation and properties of aliphatic and aromatic amines with special reference to Gabriel's Phthalamide, Reductive amination, Hinsberg and Hoffmann separation of primary, secondary and tertiary amines. Basic character of aliphatic and aromatic amines with elementary concept of steric inhibition of resonance, Electrophilic substitution in aryl amines. Diazo reaction and properties of diazonium salts, Synthesis and properties of Urea with special reference to condensation reactions.

6. ORGANIC SYNTHESIS VIA ENOATES

Acidity of α -hydrogen, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation, Keto-enol tautomerism, of ethyl acetoacetate, Alkylation and acylation of enamines.

B. Sc. SEMESTER - IV
CHEMISTRY PARTICALS

Duration : 4 1/2 hours

Max Marks: 50

1. GRAVIMETRIC ANALYSIS

- a. Principles of gravimetric analysis.
- b. Description of various glasswares and other labware used viz., desiccators, crucible, wash bottle, policemen, filter paper, etc.
- c. Concept of precipitation, co-precipitation, post-precipitation, super saturation, digestion, etc.
- d. General Gravimetric Procedure:
 - i) Precipitation and Digestion
 - ii) Filtration, washing and drying.
 - iii) Transfer of precipitate and filter paper to crucible, their ignition.
 - iv) Ash treatment, its need and significance (if required).
 - v) Heating and weighing of crucible till constant weight.
 - vi) Calculation including gravimetric factor.
- e. Estimation of :
 - i) Barium as BaSO_4
 - ii) Zinc as ZnO
 - iii) Iron as Fe_2O_3
 - Copper as CuO .

2. VIVA VOCE

3. RECORDS

B.Sc.: Semester V

Theory Paper –I : Inorganic chemistry

Duration:
Internal Assessment : 45 Minutes
End Semester Exam. : 3 Hours

Marks
Theory Paper : 60
Internal : 10
Grand Total : 70

1. Unit-1:

a) Wave mechanical concept of atom and simple molecules

(Elementary treatment only).

b) Nature of covalent bond; Heitler-London, Pauling-Slater and Hunds- Mullikan's theories, Molecular Orbital energy level diagrams and

2. Unit-2

Study of ionic solids:

Crystalline and Amorphous solids and their characteristics, types of crystalline solids, unit cell and its characteristics, ionic crystalline solids, Gouldschmidt coordination number, Radius ratio, crystal systems and their characteristics, Acquintance with structure of Rock salt, Caesium chloride, Rutile, Calcium Flourite, Zinc blande and Wurzite.

3. Unit-3

Statistical Evaluation of Data:

Errors, classification of errors, Precision and accuracy, Deviations, Standard deviations, significant figures, minimization of errors.

4. Unit-4

Environmental pollution:

(i) Air pollutants, their sources, toxic effects, control measures. Particular matter- their sources, toxic effects and control measures. Acid rain and Green house effect.

(ii) Water Pollution- water pollutants, sources, toxic effects, control measures

(iii) Remediation.

5. Unit-5.

Seminar/workshop- Review of literature, preparation of review article and power point presentation. (review article submission on seminar topic is mandatory for each student)

B.Sc.: Semester V
Theory Paper –II: Organic chemistry

Duration:
Internal Assessment : 45 Minutes
End Semester Exam. : 3 Hours

Marks
Theory Paper : 60
Internal : 10
Grand Total : 70

1. Electromagnetic spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy: absorption laws (Beer-Lambert law) molar absorptivity, presentation and analysis of uv spectra, types of electronic transitions, effect of conjugation. Concept of Chromophore and auxochrome, Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Infrared (IR) absorption spectroscopy: molecular vibrations, Hooke's law selection rules, intensity and position of IR bands, measurement of IR spectrum fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

2. Heterocyclic compounds:

Introduction: Molecular orbital picture and aromatic characteristics of Pyrrole, Furan Thiophene and Pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed six membered heterocyclic compounds. Preparation of quinoline and isoquinoline. Skraup synthesis and Bischler-Napier synthesis. Mechanism of electrophilic substitution reactions of quinoline and isoquinoline.

3. Organometallic compounds:

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions.

Organozinc compounds: formation chemical reactions

Organolithium compounds: formation chemical reactions

B.Sc.: Semester V

Theory Paper –III : Physical chemistry

Duration:

Internal Assessment : 45 Minutes

End Semester Exam. : 3 Hours

Marks

Theory Paper : 60

Internal : 10

Grand Total : 70

1. Electrochemistry:

Concept of Galvanic cells (chemical and concentration). E.M.F. Determination of : electrode concentration cells without transference reversible w.r.t cations and anions (L.J.P. eliminated by salt bridge and also by chemical cells). Liquid junction potential, cause of L.J.P, determination of L.J.P of electrolyte concentration of cell with transference reversible W.R.T. cations and anions. Determination of transport number by e.m.f measurement, chemical cells without transference. Fuel cells and their applications

2. Kinetics of catalyzed reactions.

Steady state approximation, kinetics of homogenous acid base catalysis, enzyme catalysis, negative catalysis and inhibition, kinetics of gaseous reaction on solid surface. Uni and bi molecular surface reaction. Effect of temperature on surface reaction. Primary salt effect.

3. Thermodynamics-1:

Partial molar quantities, chemical potential, Gibbs-Duhem equation, relationship between chemical potential with energy, enthalpy, work function etc. effect of temperature and pressure on chemical potential. Chemical potential of pure substances, chemical potential of real gases and fugacity, chemical potential in ideal gas mixture, thermodynamic treatment of colligative properties, lowering of vapour pressure, osmotic pressure.

4. Radiochemistry:

Definition and measurement of radioactivity, rate of atomic disintegration, radioactive equilibrium, theory of radio activity, artificial transmutation of elements, induced radio activity and nuclear. Energy, nuclear fission and fusion, radioactive isotopes.

B.Sc.: Semester V
Skill development course Research Methodology:

Duration:
End Sem.Exam.: 90min

Marks: 75
Theory end semester

B.Sc.: Semester V
Practicals

Time-6 hours

1. To determine that the acid catalyzed acetone-iodine reaction is a zero Order with respect to iodine
2. To determine the heat of neutralization of a strong acid by a strong base.
3. To determine the heat of solution by solubility method.
4. a) determination of permanent and temporary hardness of water
b) To determination the degree of hardness of water by estimating Ca^{+2} and Mg^{+2} using EDTA solution.
5. Organic synthesis: synthesis and purification of various organic compounds
 - Naphthalene picrate
 - 1-Phenylazo-2-Naphthol
 - Methyl Orange
 - Acetanilide
6. To determine the saponification value of vegetable oil.
7. To determine the molecular weight of a volatile substance by Duma's method.
8. To experimentally perform the distinction between primary, secondary and tertiary alcohols

B.Sc.: Semester VI

Theory Paper –I: Inorganic chemistry

Duration:
Internal Assessment: 45 Minutes
End Semester Exam. : 3 Hours

Marks
Theory Paper: 60
Internal: 10
Grand Total : 70

1. Unit-1:

Theories of coordination linkage: valence bond theory, outer and inner orbital (high and low spin) complexes, general ideas about crystal field theory (crystal field splitting in octahedral and tetrahedral fields only), stereochemistry of coordination number 6 and 4 coordinated compounds

2. Unit-2

Chemistry of transition element: comparative study of the chemistry of d-block elements and their important compounds. Sc, Y, La; Ti, Zr, Hf; V, Nb, Ta; Cr, Mo, W; Mn, Tc, Re; Fe, Co, Ni and Pt metals (application of reduction potential diagram wherever necessary)

3. Unit-3

General chemistry of lanthanide:

General characteristics and chemistry of f-block elements with special reference to lanthanides including lanthanide contraction and modern techniques of their separation

4. Unit-4

Material chemistry:

Introduction, principles, important discoveries and some application of Nanomaterial, liquid crystals, polymers.

5. Unit-5

Metal Ions of Biologically Significance: Essential and trace elements, chemistry of chlorophyll, hemoglobin, Myoglobin and cyanocobalamin.

B.Sc.: Semester VI

Theory Paper –II: Organic chemistry

Duration:**Internal Assessment : 45 Minutes****End Semester Exam. : 3 Hours****Marks****Theory Paper : 60****Internal : 10****Grand Total : 70**

1. Carbohydrates: classification and nomenclature, monosaccharide's, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose to mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharide. Cyclic structure of D(+)-glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides(starch and cellulose) without involving structure determination.

2. Amino acids, Peptides, Proteins and Nucleic acid

Classification, structure and stereochemistry of amino acids, acid base behavior, isoelectric point and electrophoresis. Preparation and reaction of α - amino acids. Structure and nomenclature of peptides and protein classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptide. Classical peptide synthesis, solid phase peptide synthesis. Structure of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Constituents of nucleic acids. Ribonucleosides and Ribonucleotides. The double helical structure of DNA.

3. Synthesis Polymers:

Addition or chain growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler- natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

4. Nuclear Magnetic Resonance (NMR) Spectroscopy:

Proton magnetic resonance ($^1\text{H-NMR}$) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structures, spin -spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

B.Sc.: Semester VI

Theory Paper–III :

Physical chemistry

Duration:

Internal Assessment : 45 Minutes

End Semester Exam. : 3 Hours

Marks

Theory Paper : 60

Internal : 10

Grand Total : 70

1. Atomic structure:

Bohrs theory. Sommerfields model, dual nature of electron, de-broglies equation. Experimental verification of the wave nature of electron (Davission and Germers experiments). Heisenbergs uncertainty principle, Schrodingers wave equations and physical significance of the wave function. Particle in a box (one dimension only).

2. Photochemistry:

Photochemical and thermal reactions, chain reaction, free radicals chains. Thermal decomposition of acetaldehyde and ethane. Lambert and beers law, Grothus Drapers law. Einstein law of photochemical equivalence, kinetics of photochemical reactions viz., decomposition of hydrogen iodide, hydrogen bromide, acetaldehyde, ethane etc and combination of hydrogen-chlorine, hydrogen-bromine and hydrogen –iodine reactions. Dimerisation of anthracene, fluorescence, photosensitization, phosphorescence, chemiluminescence.

3. Thermodynamics-II:

Colligative properties: Elevation of boiling point, depression of freezing point, chemical equilibrium and thermodynamic derivation of law of mass action, variation of equilibrium constant with temperature, vant hoff equation, condition for equilibrium between phases, thermal , mechanical and chemical equilibrium, derivation of phase rule.

4. Subject specific elective course (SSEC)

Duration:

End Sem.Exam.: 90min

Marks: 30

Theory end semester

Topic shall be based on physical chemistry.

B.Sc.: Semester VI

Practicals

Time-6 hours

1. To determine that the acid catalyzed hydrolysis of methyl acetate is a first order reaction.
2. To determine the effect of the concentration of HCl or H₂SO₄ on the rate constant for the hydrolysis of methyl acetate.
3. To determine the strength of the given HCl solution conductometrically.
4. Determination the concentration of unknown K₂Cr₂O₇ and CuSO₄ by calibration graph method, colorimetrically
5. To perform the one step preparation of some organic compounds.
6. To determine the iodine value of given vegetable oil.
7. To determine the iodine number of given vegetable oil.
8. To perform the synthesis of the following addition and coordinate compounds
 - a. Na-Trioxalato ferrate
 - b. Potash alum
 - c. Carnalite.
 - d. Potassium hexa cyano ferrate.