Maharaja Surajmal Brij University

Bharatpur (Raj.)

SYLLABUS

B.Sc. CHEMISTRY

(Part I, II, III)

Only For Session
2020-21

B.Sc. Part I, Session 2020-21
Chemistry

Scheme:

Max Marks: 150

	Duration (hrs.)	Max. Marks	Min. Pass Marks
Paper I	3	33	
Paper-II	3	33	36
Paper-III	3	34	
Practical	5	50	18

Note: Ten (10) questions are to be set taking two (02) questions from each unit. Candidates have to answer any 5 questions selecting at least one question from each unit.

CH-101 Paper I : Inorganic Chemistry
(2 hrs or 3 periods/ week)

Unit-I

Ionic Solids: Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarisability of ions, Fajan's rule.

Unit-II

Covalent Bond: Directional and Shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, ClF_3, ICl_2, H_2O.

Molecular Orbital Theory: Homonuclear and heteronuclear (CO and NO) diatomic molecules, bond strength and bond energy, percentage Ionic character from dipole moment. electronegativity difference.

Unit-III

S-Block Elements: Comparative study, diagonal relationships, salient features of hydrides, solvation, an introduction of alkyls and aryls.

Periodicity of p-block elements: Periodicity in properties of p-block elements with special reference to atomic and ionic radii, ionization energy, electron affinity, electro negativity, diagonal relationship, catenation.

Unit-IV

Some Important Compounds of p-block Elements: Hydrides of boron, diborane and higher hornnes, horazine, borazine, fullerenes, carbides, (structural principle), basic properties of halogens, interhalogens.

Chemistry of Noble Gases: Chemical properties of the noble gases, chemistry of Xenon, structure and bonding in Xenon compounds.

Unit- V

Nuclear Chemistry: Fundamental particles of nucleus (nucleons); Concept of nuclides and its representation; Isotopes, Isobars and Isotones (with specific examples);

Radiochemistry: Natural and artificial radioactivity; Radioactive disintegration series; Radioactive displacement law; Radioactivity decay rates; Half life and average life; Nuclear binding energy, Nuclear fission and fusion.

CH-102 Paper II : Organic Chemistry

(2 hrs or 3 periods / week)

Unit-I

Mechanism of Organic Reactions: Homolytic and heterolytic bond cleavage. Types of reagents, electrophiles and nucleophiles, Reactive intermediates - carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Types of organic reactions. Energy considerations.

Unit-II

Stereochemistry of Organic Compounds: Concept of isomerism, Types of isomerism, Difference between configuration and conformation, Flying wedge and Fischer projection formulae.

Optical Isomerism: Elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity. Chiral and achiral molecules with two stereogenic centres. Diastereomers, threo and erythro isomers, meso compounds. Resolution of enantiomers. Inversion, retention and racemization (with examples).

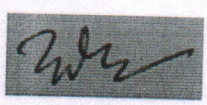
Relative and Geometric Isomerism determination of Configuration of Geometric Isomers cis/trans and E / Z systems of nomenclature.

Conformational Isomerism: Newman projection and Sawhorse formulae, Conformational analysis of ethane, n-butane.

Unit-III

Alkanes and Cycloalkanes : Classification of carbon atoms in alkanes. Methods of formation (with special reference of Wurtz reaction, Kolbe reaction. Corey House reaction and decarboxylation of carboxylic acids. Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation, Orientation, reactivity and selectivity. Cycloalkanes - nomenclature, methods of formation, chemical reactions. Baeyer's strain theory and its limitations. Theory of strainless rings.

Alkenes, Cycloalkenes, Dienes and Alkynes : Methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides. Regioselectivity in alcohol dehydration - the Saytzeff rule, Hoffmann elimination, Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions. Markownikoff's rule, hydroboration-oxidation, oxymercurarion-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$ Polymerization of Alkenes.



Unit-IV

Arenes and Aromaticity: The aryl group, aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram. Aromaticity: the Huckel rule, aromatic ions - three to eight membered.

Aromatic electrophilic substitution: General pattern of the mechanism, role of sigma and pi-complexes. Mechanism of nitration, halogenation, sulphonation, Friedel-Crafts reactions and chloromethylation. Activating and deactivating substituents. Directive influence - orientation and ortho/para ratio.

Unit-V

Alkyl and Aryl Halides: Methods of formation of alkyl halides, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides S_N2 and S_N1 reactions with energy profile diagrams.

Polyhalogen compounds: Chloroform, carbon tetrachloride.

CH-103 Paper III: Physical Chemistry

(2 hrs. or 3 Periods/week)

Unit-I

Mathematical Concepts: Logarithmic relations, curve sketching, linear graphs and calculations of slopes, differentiation of functions like K_x, e^x, x^n, sinx and log x; maxima and minima, partial differentiation and reciprocity relations, integration of some useful/relevant functions :

Liquid State: Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases.

Unit- II

Gaseous States: Postulates of kinetic theory of gases, deviation from ideal behavior, van der walls equation of state.

Critical Phenomenon: PV isotherms of real gases, the isotherms of van der walls equation, relationship between critical constants and van der walls constants, the law of - corresponding states, reduced equation of state.

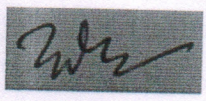
Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities. Liquification of gases (based on Joule-Thomson effect.)

Unit- III

Solid State: Definition of space lattice, unit cell.

Laws of crystallography- (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

Basic concept of X-ray diffraction by crystals. Derivation of Bragg's equation Determinatioin of Crystal structure of NaCl and powder method.



Unit-IV

Colloidal State: Definition of colloids, classification of colloids.

Solids in liquids (sols) properties- kinetic, optical and electrical, stability of colloids. Protective action, Hardy-Schulze law, gold number.

Liquids in liquids (emulsions): types of emulsions, preparation. Emulsifier.

Unit-V

Chemical Kinetics: Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction, concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions - zero order, first order, second order; pseudo order, half-life and mean-life. Determination of the order of reactions - differential method, method of integration, method of half-life period and isolation method.

Theories of chemical kinetics. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model transition state theory (equilibrium hypothesis).

Practical: CH-104: Laboratory Course -I

(4 hrs or 6 periods / week)

(Instructions to the Examiners)

CHY 104: Chemistry Practical (Pass course)

Max. Marks: 50 **Duration of Exam: 5 hrs.** Minimum

Inorganic Chemistry		
Ex.1	Separation and identification of 3 cations and 3 anions in the mixture	15
Organic Chemistry		
Ex.2	Laboratory Techniques	
Ex. 3	Qualitative Analysis	3
	Detection of element and detection of functional group	
Physical Chemistry		10
Ex. 4	Perform one of the experiments mentioned in the syllabus.	
Ex. 5	Viva-voce	12
Ex. 6	Record	5
	Total	

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B.Sc. Part II, Session 2020-21
Chemistry

Scheme:

Max Marks: 150

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Paper-II	3	33	36
Paper-III	3	34	
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CH-101 Paper I : Inorganic Chemistry
(2 hrs or 3 periods/ week)

Unit-I

Chemistry of Element of first Transition Series:

Characteristic properties of d-block elements. Properties of the elements of the first transition series. Their binary compounds and complexes illustrating relative stability of their oxidation -states. Coordination number and geometry.

Unit-II

Coordination Compounds:

Werner's coordination theory and effective atomic number concept chelates. Nomenclature of coordination compounds. Isomerism in coordination compounds.

Unit-III

Chemistry of Lanthanide and Actinide Elements:

Electronic structure. Oxidation states. Ionic radii and lanthanide contraction, Complex formation

General features. Electronic configuration oxidation states magnetic properties. Complexation behavior, comparison of lanthanides and actinides. super heavy elements.

Unit IV

Oxidation and Reduction:

Analysis of redox cycle. Redox stability in water frost Latimer. Application of redox data in the extraction of elements.

Unit -V

Acids and Bases:

Theories : Arrhenius. Bronsted- Lowry, Lux-Flood, Solvent system concept and Lewis concept of acids and bases.

Non-aqueous Solvents:

Physical properties of a solvent, types of solvents and their general characteristics, reactions in nonaqueous solvents with reference to liquid NH_3.

CH-202 Paper-II: Organic Chemistry

(2 hrs. or 3 periods/week)

Unit-I

Electromagnetic Spectrum : An introduction

Absorption Spectroscopy

Ultraviolet (UV) spectroscopy- Absorption laws (Beer- Lambert law , molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions. Effect of solvents on transitions.

Infrared (IR) spectroscopy - Molecular vibrations, Hook's law .selection rules, intensity and position of IR bands. Measurement of IR spectrum, fingerprint region.

Unit-II

Alcohols - Classification and nomenclature.

Monohydric alcohols- Methods of formation by reduction of aldehydes, ketones carboxylic acids and esters. Hydrogen bonding . Acidic nature, Reactions of alcohol with mechanism. Dihydric alcohols – methods of formations. Chemical reactions of vicinal glycols, oxidative, Trihydric alcohols method of formation. Chemical reactions of glycerol.

Phenols- Nomenclature structure and bonding Preparation of Phenols Physical properties and acidic character, comparative acidic strength of alcohols and phenols. Reactions of phenols electrophilic aromatic substitution. Acylation and carboxylation Mechanism of Fries rearrangement. Claisen rearrangement. Gatterman synthesis. Hauben reaction, Lederer-Manasse reaction and reamer-Tiemann reaction.

Unit- III

Aldehydes and Ketones : Structure of the carbonyl group. Syntheses of aldehydes from acid chlorides synthesis of aldehydes and ketones using 1,3-dithianes and from carboxylic acids. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol. Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives Witting reaction , Mannich reaction. Oxidation of aldehydes , Baeyer - Villiger oxidation of ketones, Cannizzaro reactions MPV (Meerrvein, Pondrof-Verlay), Clemmensen, reductions.

Unit-IV

Carboxylic Acids

Structure and bonding, physical properties. acidity of carboxylic acids, effects of substituens on acid strength, preparation of carboxylic acids. Reactions of carboxylic acids, Hello- Volhard – Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation.

Methods of formations and chemical reactions of halo acids. Hydroxy acids- malic tartaric and citric acids.

Unit V

Organic compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reaction of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid.

Amines structure nomenclature and preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles) reductive amination of aldehydic and ketonic compounds. Physical properties stereochemistry of amines.

CH-203 Paper III : Physical Chemistry

(2 hrs. or 3 periods/week)

Thermodynamics-I

First Law of Thermodynamics: Statement definition of internal energy and enthalpy, heat capacity. Heat capacities at constant volume and pressure and their relationship. Joule's law, JouleThomson coefficient and inversion temperature. Calculation of w.q. du & dh for the expansion of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchoff's equation.

Unit -II

Thermodynamics -II

Second Law of Thermodynamics : Need for the law , different statements of the law. Cannot cycle and its efficiency, Carnot- Theorm. Thermodynamic scale of temperature.

Concept of Entropy: Entropy as a state function. Entropy as a function of V&T, entropy as a function of P&T. entropy change in physical change. Clausius inquality and entropy as criteria of spontancity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third Law of Thermodynamics : Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions Gibbs function (G) and Helmholtz function (A) as: thermodynamic quantities.

Unit -III

Phase Equilibrium: Statement and meaning of the terms: phase component and degree of freedom, derivation of Gibbs phase rule, phase equilibra of one component system -water, CO_2, and Sulphur systems.

Liquid- Liquid mixtures: Ideal liquid mixture. Raoult's and Henry's Law, Non ideal system azcotropes HCl-H_2O and ethanol -water systems. Partially miscible liquids : phenol-water, lower distribution law thermodynamic derivation. Application.

Unit IV

Electrochemistry-I

Electrical transport- conduction in metals and in electrolyte solutions, Specific conductance and equivalent conductance, measurement of equivalent conductance. Variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes (elementary treatment only). Transport number, definition and determination by moving boundary method.

Unit- V

Electrochemistry- II

Types of reversible electrodes : Gas- metal- ion, metal – insoluble salt anion and redox electrode, potential, standard hydrogen electrode, reference electrodes of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells – reversible and irreversible cells conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computations of cells EMF. Calucation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), Polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential.

Suggested Books:

1. Principles of Physical Chemistry : B.R. Puri, Sharma and M.S. Pathania
2. A Text Book of Physical Chemistry : A.S. Negi and S.C. Anand,
3. A Text Book of Physical Chemistry : Kundu and Jain
4. The elements of Physical Chemistry : P.W. Atkins Oxford.
5. University General Chemistry : C.N.R. Rao, Mac Millen

CH-204 Chemistry Practical (Pass Course), Laboratory Course-II

(Instructions to the Examiner)

B.Sc. Part II

CH-204 Chemistry Practical (Pass Course)

Max.Marks: 50 **Duration of Exam : 5 hrs.** **Min. Pass Marks: 18**

Inorganic Chemistry

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Ex.1 Volumetric Analysis

Or

Giravimetric Analysis as mentioned in the syllabus 16

Organic Chemistry

Ex.2 Identification of two organic compounds (one solid and one liquid)through the functional group analysis, determination of melting point, boiling point and preparation of suitable derivaties.

Or

Perform one experiment out of the experiments on thin layer and paper chromatography given in syllabus. 12

Physical Chemistry

Ex.3 Perform one of the physical chemistry experiments as mentioned in the syllabus 12

Ex. 4 Viva – voce 5

Ex.5 Record 5

50

Books Suggested (Theory Course)

1. Basic Inorganic Chemistry F.A. Cotton: G.Wilkinson and P.L. Caus Wiley.
2. Concise Inorganic Chemistry .J.D.Lee. ELBS
3. Concepts Inorganic Chemistry B. Doughts. D. Me Danial and J. Alexander
4. Inorganic Chemistry. D.F. Shriver P.W. Atkins and C.H. Langford .Oxford .
5. Inorganic chemistry. W.W. Porterfield Addison Wesley
6. Inorganic Chemistry. A.G. Sharpe EI BS
7. Inorganic Chemistry. G.I. Miessler and D.A. Tarr. Prentice Hall
8. Organic Chemistry. Morrison and Boyd. Prentice Hall
9. Organic Chemistry. L.G. Wade ji Prentice Hall
10. Fundamental of Organic Chemistry. Solomons. John Wiley.
11. Organic chemistry Vol. I,II,III S.M. Mukher ji, S.P. Singh, and R.P. Kapoor, Wiley Eastern Ltd. (New Age International)
12. Organic Chemistry, F.A. Carey, McGraw Hill, Inc.
13. Introduction to Organic Chemistry, Strecitwicscr. Heathcock and Kosover, Macmilan
14. Physical Chemistry.G.M. Barrow. International Student Edition, McGraw Hill
15. Basic Programming with Application, V.K. Jain Tata McGraw Hill

Unit IV

Electrochemistry-I

Electrical transport- conduction in metals and in electrolyte solutions, Specific conductance and equivalent conductance, measurement of equivalent conductance. Variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes (elementary treatment only). Transport number, definition and determination by moving boundary method.

Unit- V

Electrochemistry- II

Types of reversible electrodes : Gas- metal- ion, metal – insoluble salt anion and redox electrode, potential, standard hydrogen electrode, reference electrodes of cell E.M.F. and single electrode potential, standard hydrogen electrode, reference electrodes standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells – reversible and irreversible cells conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computations of cells EMF. Calucation of thermodynamic quantities of cell reactions (ΔG, ΔH and K), Polarization, over potential and hydrogen over voltage .

Concentration cell with and without transport, liquid junction potential.

Suggested Books:

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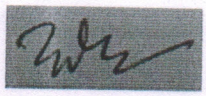
CH-204 Chemistry Practical (Pass Course), Laboratory Course-II

(4 hrs. or 6 periods/week)

All experiments from previous syllabus



B.Sc. Part III, Session 2020-21
Chemistry

Scheme:

Max Marks: 150

	Duration (hrs.)	Max. Marks	Min. Pass Marks
Paper1	3	33	
Paper-II	3	33	36
Paper-III	3	34	
Practical	5	50	18

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CH-301 Paper-I : Inorganic Chemistry
(2 hrs or 3 periods/week)

Unit-I

Hard and Soft Acids and Bases (HSAB):

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, electronegativity and hardness and softness.

Unit-II

Metal-ligand bonding in Transition Metal complexes:

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal-field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Magnetic properties of Transition Metal Complexes:

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling.

Unit-III

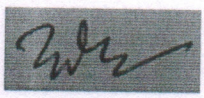
Electron spectra of Transition Metal Complexes:

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6I^{3+}]$ complex ion.

Unit-IV

Organometallic Chemistry:

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, a brief account of metalethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.



Unit-V

Bioinorganic Chemistry:

Essential and trace elements to Biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} Nitrogen fixation.

CH-302 Paper-II : Organic Chemistry

(2 hrs or 3 periods/week)

Unit-1

Nuclear Magnetic Resonance (NMR) Spectroscopy:

Proton magnetic resonance (1H-NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals. Interpretation of NMR 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 NMR data.

Unit-II

Heterocyclic Compounds Introduction: Molecular orbital diagram and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five- and six-membered heterocyles. Preparation and reactions of indole quinoline and isoquinoline with special reference to Fisher-indole synthesis, Skraup synthesis.

Unit-III

Carbohydrates Classification and nomenclature, Monosaccharides, mechanism of osazone formation. Epimers, anomers and mutarotation. Interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Erythro and threo diastereomers. Conversion of glucose into mannose. Configuration of monosaccharides. Determination of ring size of monosaccharides. Formation of glycosides, ethers and esters. Cyclic structure of D(+)-glucose and fructose.

Unit-IV

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and acid-base behaviour, isoelectric point and electrophoresis.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end-group analysis, selective hydrolysis of peptides.

Nucleic acids - Introduction, constituents of nucleic acids - and nucleotides.

Unit-V

Organosulphur Compounds : Nomenclature, structural features, methods of formation and chemical reactions of thiols, sulphonic acids, sulphonamides and

Sulpha drugs: sulphaguanidine, sulphadiazine (sulphapyrimidine), sulphamethoxazole, sulphacetamide.

Synthetic Dyes : Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of methyl orange, congo red, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and indigo.

CH-303 Paper III: Physical Chemistry

(2 Hrs. or 3 periods/week)

Unit-I

Elementary quantum Mechanics:

Black-body, radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's mode of hydrogen atom (no derivation) and its defects. Compton effect.

De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom

Unit-II

Molecular orbital theory:

Basic ideas-criteria for forming M.O. from A.O. construction of M.O's by LCAO-H_2^+ ion calculation of energy level from wave functions, physical picture of bonding and bonding wave functions, concept of σ, σ^*, π, π^* orbitals and their characteristics. Hybrid orbitals - sp, sp^2, sp^3, calculation of coefficients of A.O.'s used in these hybrid orbitals.

Unit-III

Spectroscopy

Introduction: Electromagnetic radiation, spectrum, basic features of different spectrometers, statement of the Born-Openheimer approximation, degrees of freedom.

Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect.

Vibrational Spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies.

Electronic Spectrum: Concept of Potential Energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank Condon principle. Qualitative description of σ, π and n M.O. their energy levels and the respective transitions.

Unit-IV

Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark -Einstein law, Jablonski diagram depicting various processes occurring in the exited sate, qualitative description of fluorescence, phosphorescence, non-radiative processes internal conversion, intersystem crossing).

Unit-V

Solutions, Dilute Solutions and Colligative Properties: Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity coefficient.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapor pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weight and elevation of boiling point and depression in freezing point.

Practical: CH-304: Laboratory Course - III

(6 hrs/week)

INORGANIC CHEMISTRY

Synthesis and Analysis of:

a) Potassium trioxalatoferrate (III), $K_3[Fe(C_2O_4)_3]$

b) Bis (dimethylglyoximato) nickel (II) complex, $[Ni(DMG)_2]$

c) Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4$

d) Potassium cis-diaquabis(oxalato)chromate (III) dihydrate, $K[cis\text{-}Cr(H_2O)_2(C_2O_4)_2].2H_2O$

Instrumentation

Calorimetry

(a) Job's

(b) Mole-ration method

Adulteration-Food stuffs

Effluent analysis water analysis

Solvent Extraction

Separation and estimation of Mg (II) and Fe (II)

Ion Exchange Method

Separation and estimation of Mg (II) and Fe (II)

ORGANIC CHEMISTRY

Laboratory Techniques

Steam Distillation

Naphthalene from its suspension in water

Clove oil from Clove

Separation of o- and p-nitrophenols

Column Chromatography

Separation of fluorescein and methylene blue

Separation of leaf pigments from spinach leaves

Resolution of racemic mixture of (+) mendelic acid

Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, for separation and preparation of suitable derivatives.

Synthesis of Organic Compounds

(a) Aliphatic electrophilic substitution

Preparation of iodoform from ethanol and acetone

(b) Aromatic electrophilic substitution

Nitration

Preparation of m-dinitrobenzene

Preparation of p-nitroacetanilide

Halogenation

Preparation of p-bromoacetanilide

Preparation of 2, 4, 6-tribromophenol

(c) Diazotizatoin / coupling

Preparation of methyl orange and methyl red

(d) Oxidation

Preparation of benzoic acid from toluene

(e) Reduction

Preparation of aniline from nitrobenzene

Preparation of m-nitroaniline from m-dinitrobenzene.

Stereochemical Study of Organic Compounds via Models

R and S configuration of optical isomers.

E, Z configuration of geometrical isomers.

Conformational analysis of cyclohexanes and substituted cyclohexanes.

PHYSICAL CHEMISTRY

Electrochemistry

(a) To determine the strength of the given acid condcutometrically using standard alkali solution.

(b) To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.

(c) To study the saponification of ethyl acetate conductometrically.

(d) To determine the ionization constant of a weak acid conductometrically.

(e) To titrate potentiometrically the given ferrous ammonium sulphate solution using $KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{++}/Fe^{+++} system on the hydrogen scale.

Refractometry, Polarimetry

(a) To verify the law of refraction of mixture (e.g. of glycerol and water) using Abbe's refractometer.

(b) To determine the specific rotation of a given optically active compound.

Molecular Weight Determination

(a) Determination of molecular weight of a non-volatile solute by Rast method/Beckmann freezing point method.

(b) Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

Colorimetry

(a) To verify Beer-Lambert law $KMnO_4/K_2Cr_2O_7$, and determined the concentration of the given solution of the substance.

(Instructions to the Examiner)

CH-304 Chemistry Practical (Pass Course)

Max. Marks: 50 Duration of Exam:5 hrs. Minimum marks: 18

Inorganic Chemistry

Synthesis and Analysis of one of the four syntheses given in the syllabus.

OR

Separation and estimation of Mg (II) and Fe (II) by solvent extraction method.

OR

Separation and estimation of Mg (II) and Fe (II) by ion exchange method. 10

Organic Chemistry

(1) Synthesis of one of the six organic preparations. 8

(2) Analysis of an organic mixture containing two solid components using water / $NaHCO_3$/ NaOH and preparation of suitable derivatives.

OR

Column chromatography techniques.

Perform one of the three column chromatography experiments given in syllabus. 10

Physical Chemistry

Perform one of the physical chemistry experiments given in the syllabus. 12

Viva-voce **5**

Record **5**

50

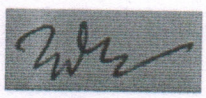
Books Suggested (Theory Course)

1. Basic Inorganic Chemistry F.A. Cotton. G. Wilkinson and P.L. Caus. Wiley.
2. Concise Inorganic Chemistry, J.D. Lee, ELBS
3. Concepts of Models of Inorganic Chemistry B. Douglas. D. McDaniel and J. Alexander, John Wiley.

4. Inorganic Chemistry, D.E. Shriver P.W. Atkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield Addison Wesley.
6. Inorganic Chemistry, A.G. Sharpe, ELBS
7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. Organic Chemistry, Morrison and Boyd, Prentice Hall.
9. Organic Chemistry, L.G. Wade Ji. Prentice Hall.
10. Fundamentals of Organic Chemistry, Solomons, John Wiley.
11. Organic Chemistry Vol. 1, 11, III S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International)
12. Organic Chemistry, F.A. Carey, McGraw Hill, Inc.
13. Introduction to Organic Chemistry. Streitwieser. Heathcock and Kosover. Macmilan.
14. Physical Chemistry, G.M. Barrow. International Student Edition, McGraw Hill.
15. Basic Programming with Application, V.K. Jain. Tata McGraw Hill.
16. Computers and Common Sense. R. Hunt and Shelly, Prentice Hall.
17. University General Chemistry, C.N.R. Rao, Macmillan.
18. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
19. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
20. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative inorganic Analysis, revised, Svehla, Orient Longman.
2. Vogel's Textbook of Quantitative Inorganic Analysis (revised), J. Bassett. R.C. Deney, G.H. Jeffery and J. Mendham. ELBS.
3. Standard Methods of Chemical Analysis. W.W. Scott. The Technical Press.
4. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.
5. Handbook of preparative Inorganic Chemistry. Vol (& II, Braver, Academic Press.
6. Inorganic Synthesis, McGraw Hill.
7. Experimental Organic Vol I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, 'rata McGraw Hill.
8. Laboratory manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
9. Vogel's Textbook of Practical Organic Chemistry, RS. Furniss, Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
11. Experiments in Physical Chemistry, R.C.Das and B. Behra, Tata McGraw Hill.
12. Advanced Practical Physical Chemistry, J.
13. Yadav, Goel Publishing House. 3. Advanced Experimental Chemistry, Vol. 1- Physical, J.N. Gurtii and R. Kapoor, S. Chand & Co.



14. Selected Experiments in Physical Chemistry, N.G. Mukerjee. J.N. Ghjose & Sons.
15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan. (Instructions to examiners)