St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
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Chemistry Syllabus Session 2019-20

Class B.Sc. (I) Year Paper – I (Physical Chemistry) ***Maximum Marks: 27***

UNIT - I

(A) Mathematical Concepts: Logarithmic relations, (rules and types), use of log table and anti-log table in calculations, curves sketching, straight line and linear graphs, calculation of slopes. Differentiation of functions like k_x, e^x, x^n, sin x, log x; multiplication and division in differentiation, maxima and minima, partial differentiation. Integration of some useful/relevant functions; Factorials, Probability.

(B) Gaseous States and Molecular Velocities: Critical phenomenon: PV isotherms of ideal gases, Andrew's experiment, continuity of states, the isotherms of Van der Waals equations, relationship between critical constants and Van der Waals constants.
Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision numbers, mean free path and collision diameter.

UNIT - II

(A) Liquid State: Intermolecular forces, structure of Liquids (a qualitative description). Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell.

(B) 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) Laws of symmetry, symmetry elements in crystals. Ionic solid structure, radius-ratio rule and radius-ratio effect and coordination number, limitation of radius-ratio rule, lattice defects, ***Crystallization of sugar from sugar cane juice***.

UNIT - III

Chemical Kinetics : Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction – concentration, temperature, pressure, solvent, light and catalyst. Dependence of rate on concentration, mathematical characteristics of simple chemical reactions: zero order, first order, second order, pseudo order, half-life and mean life. Determination of the order of reaction, differential method, integration method, half-life method. Study of chemical kinetics by polarimetry and spectrophotometry. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy, simple collision theory, transition state theory (equilibrium hypothesis).

UNIT - IV

Radioactivity and Nuclear Chemistry: Natural and artificial radioactivity, radioactive radiations, detection and measurement of radioactive radiations, theory of radioactivity. Group displacement

law of Soddy, radioactive disintegration, nuclear reactions, nuclear fission and nuclear fusion, half life period, isotopes, isobars and isomers, application of radiochemistry.

UNIT - V

(A) Chemical Equilibrium: Law of mass action, Equilibrium constant, Le-Chatelier's Principles ***Oscillation reaction.***

(B) Colloidal Solutions: Classifications, lyophilic and lyophobic colloids, properties: kinetic, optical and electrical, coagulation. Hardy-Schulze rule, gold number, emulsions, gels and sols, application of colloids:- ***Purification of water, sewage disposal, Artificial rain, preparation of butter, pathological test .***

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Class B.Sc. (I) Year Paper – II (Inorganic Chemistry) ***Maximum Marks: 28***

UNIT - I

(A) Atomic Structure: Dual nature of matter, idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbital, Schrödinger wave equation, significance of ψ and ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of *s*, *p*, *d* orbital. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configuration of the elements, effective nuclear charge ***Modelling using ball and stick models***.

(B) Periodic Properties: Atomic and ionic radii, ionization energy, electron affinity and electronegativity – definition, method of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

UNIT - II

Chemical Bonding – Part I - (A) Covalent bond: Valence bond theory and its limitations, directional characteristic of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_30, SF_4, ClF_3, and H_2O. MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and the bond energy, percentage ionic character of covalent bond.

UNIT - III

(1) Chemical Bonding Part II - (B) Ionic Solids : Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy, energetics of sodium chloride and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond: free electron, valence bond and band theories.

(C) Weak interaction : Hydrogen bond and types of Hydrogen bonding, van der Waals forces.

(2) Chemistry of Noble Gases: Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

UNIT - IV

(1) *s*-Block Elements: Comparative study – Li and Mg, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.

(2) *p*-Block Elements Part I : Comparative study – Be and Al (including diagonal relationship) of groups 13 - 17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13 - 16.

UNIT - V

***p*-Block Elements Part II:** Hydrides of boron – diborane and higher boranes, borazine, borohydrides. Fullerenes, Carbides, Fluorocarbons, Silicates (structural principle), tetrasulphur, tetranitride, basic properties of halogens, interhalogens and Polyhalides.

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Class B.Sc. (I) Year Paper – III (Organic Chemistry) ***Maximum Marks: 28***

UNIT - I

(A) Structure and Bonding: Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, inductive, electromeric, mesomeric and steric effect

(B) Mechanism of Organic Reactions: Homolytic and heterolytic bond fission, Types of reagents –electrophiles and nucleophiles. Types of organic reaction, energy consideration. Reactive intermediates (carbocations, carbanions, free radicals, carbenes, arynes and nitrene with examples). Methods of determination of reaction mechanism(active intermediate products) isotope effects, kinetic and stereochemical studies.

UNIT - II

Alkanes and Cycloalkanes: IUPAC nomenclature of branched and unbranched alkanes, classification of alkanes. Isomerism in alkanes, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, conformation of alkanes, Mechanism of free radical halogenation of alkanes.

Cycloalkanes: nomenclature, methods of formation, chemical reaction, Baeyer strain theory and its limitation, Theory of strainless rings. The case of cyclopropane ring: Banana bonds, conformation of cycloalkane.

UNIT - III

Alkenes, Cycloalkenes, Dienes : Nomenclature of alkenes, methods of formation – Mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes – mechanisms involved in hydrogenation, electrophilic and free radical addition. Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction, Epoxidation, ozonolysis. Polymerization of alkenes, Substitution at the allylic and vinylic positions. Industrial application of ethylene and propene.

Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes : isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerisation.Chemical reactions – 1, 2 and 1, 4 additions, Diels-Alder reaction.

UNIT - IV

Alkynes and Alkyl Halides: Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions, acidity of alkynes.Mechanism of electrophilic and nucleophilic addition reaction, hydroboration-oxidation, metal-ammonia reduction, oxidation and polymerization.

Nomenclature and classes of alkyl halides, methods of formation: Chemical reactions. Mechanisms of nucleophilic substitution reaction of alkyl halides, S^1_N and S^2_N reactions with energy profile diagrams, Elimination reaction. Polyhalogen compounds : methods of preparation and properties of Chloroform and carbon tetrachloride.

UNIT - V

Stereochemistry of Organic Compounds: Concept of isomerism, types of isomerism. Optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configurations, sequence rule, D & L and R & S systems of nomenclature.Geometrical isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compound ***Isolation of D-L isomers***.

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Class B.Sc. (I) Year Paper : Practical ***Maximum Marks: 50***
Duration of Practical Exam - 4 hours
Physical Chemistry

(A) Any one experiment 12 marks

1. Determination of melting point

2. Preparation of solutions of various concentrations NaOH

(B) Any one experiment 12 marks

1. Determination of surface tension/percentage composition of given organic mixture by using Stalagmometer

2. Determination of viscosity / percentage composition of given liquid mixture by using Viscosity method

Organic Chemistry ***12 marks***

1. Distillation

2. Crystallization

3. Sublimation

4. Detection of elements and functional groups

Inorganic Chemistry ***08 marks***

Inorganic mixture analysis
1. Mixture Analysis for 2 Cations and 2 Anions

2. Separation of cations by paper chromatography

Viva **:** ***06 marks***

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Class B.Sc. (II) Year Paper – I (Physical) ***Maximum Marks: 29***

UNIT - I

Thermodynamics: Basics Concepts of thermodynamics. First Law, Second law of thermodynamics: Need for law, Different statements of the law, Carnot cycle and its efficiency. Carnot theorem. Thermodynamics Scale of temperature. Concepts of entropy: entropy as a state Function entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium.Entropy change in ideal gases and mixing of gases. 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 (H) as a thermodynamic quantities, A and G a as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change.

B. Thermochemistry: Standard state, standard enthalpy of formation: Hess's Law of heat summation and its application.Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization.

UNIT - II

Phase equilibrium : statement and the meaning of terms: phase, component and the degree of freedom, thermodynamic derivation of the Gibbs phase rule, one component system: water, CO2 and S system, two component system: solid-liquid equilibria, simple eutectic system: Bi-Cd; Pb-Ag system, Desilverisation of lead.

Solid solution : Systems in which compound formation with congruent melting point (Zn-Mg) and incongruent melting point,(NaCl-H2O) and (CuSO4-H2O) system, Freezing Mixtures: acetone-dry ice.

Liquid–Liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system, azeotrops; HCl-H2O and ethanol water system.

Partial miscible liquids: Phenol-water, trimethylamine – water and nicotine-water system.Lower and upper consolute temperature. Immiscible Liquids, steam distillation, Nernst distribution law: thermodynamic derivation, applications.

UNIT - III

Electrochemistry

A. Electrical transport, conduction in metals and in electrolyte solutions, specific and equivalent conductance, Measurement of equivalent conductance effect of dilution on conductivity Migration of ions and Kohlrausch-law, Arrhenius theory of electrolyte dissociation and its limitations, weak

and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel Onsager's equation for strong electrolytes (elementary treatment only). Transport number: Definition and determination by Hittorf method and moving boundary method. Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode, standard electrode potential, Electrochemical Series and its significance.

UNIT - IV

Electrochemistry

Types of reversible electrodes Gas Metal ions, metal-meal ion, metal-insoluble salt anion and redox electrodes. Electrolyte and galvanic cells, reversible and irreversible cell conventional representation of electrochemical cell.Concentration cell with and without transport, liquid junction potential application of concentration cell valancy of ions, solubility product and activity coefficient. Potentiometric titration. Definition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.

Buffers: Mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts,

UNIT - V

Surface Chemistry : Adsorption, adsorption and absorption, types of adsorbtion adsorption of gases and liquids on solid adsorbent, Freundlich and Langmuir adsorption isotherms, Surface area and determination of surface area,

A. Catalysis characteristics of catalyzed reaction, Classification of catalysis application of catalysts, miscellaneous examples.

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Class B.Sc. (II) Year Paper – II (Inorganic Chemistry) ***Maximum Marks: 28***

UNIT - I

Chemistry of Element of First Transition Series:

A. Chemistry of elements of I transition series : Characteristics properties of d-block elements. Properties of the elements of the first transition series, their binary compounds such as carbides, oxides and sulphides.Complexes illustrating relative stability of their oxidation states, coordination number and geometry.

UNIT - II

Chemistry of elements of II and III transition series: General characteristics comparative treatment with 3d-analogues respect to ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

UNIT - III

A. Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature, of effective atomic number concept, Chelates, nomenclature of coordination compounds, Isomerism in coordination compounds, Valance Bond Theory of transition metal complexes.

Oxidation and Reduction

Use of redox patented data analysis of redox cycle, redox stability in water: Frost, Latimer and Pourbaux diagrams. Principle involved in the extraction of elements.

UNIT – IV

General chemistry of f-block elements:

Chemistry of Lanthanides: Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

Chemistry of Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Similarities between the later actinides and later lanthanides.

UNIT - V

Acids and Bases:

Arrhenius, Bronsted Lowry, Lux-Flood, Solvent System, and Lewis concept of acid and bases.

Non Aqueous Solvents: Physical property of solvent, types of solvent and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

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Class B.Sc. (II) Year Paper – III (Organic Chemistry) ***Maximum Marks: 28***

UNIT - I

Electro Magnetic Spectrum: Absorption Spectra, ultraviolet (UV) absorption spectroscopy, absorption laws (Beer-Lambert's law). Molar absorptivity, Presentation and analysis of UV spectra, types of Electronic transition, 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, Hook's law, Selection rules, Intensity and position of IR bands, Measurements of IR spectra, Fingerprint region, characteristics of absorption of various functional group and interpretation of IR spectra of sample organic compound.

UNIT - II

A. Alcohols : Classification and nomenclature. Monohydric alcohols- nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acid, and esters, Hydrogen bonding, nature and reactions of alcohols.

Dihydric Alcohols: Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$, and HIO_4] and pinacol-pinacolone rearrangement.Trihydric alcohols - nomenclature and methods of formation, chemical reaction of glycerol.

B. Phenols: Nomenclature, structure and bonding.Preparation of phenols, physical property and acidic character.Comparative acidic strength of alcohols and phenols, stabilization of phenoxide ion. Reaction of Phenols-Electrophilic aromatic Substitution, acylation and carboxylation Mechanisms of Fries rearrangements, Claisen rearrangement Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Riemer- Tiemann reaction.

UNIT - III

Aldehydes and Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes and ketones from acid chlorides, synthesis of aldehydes and ketones using. 1,3 dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knovenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction, use of acetals as protecting group. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizaro reaction. Meerwein Pondroff-Verley, Clemmesen, Wolf Kishner, $LiAlH_4$ and $NaBH_4$ reduction. Halogenation of enolizable ketones, An introduction to alfa, beta, unsaturated aldehydes and ketones.

UNIT - IV

Carboxylic acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, Effect of substituent on acid strength. Preparation of carboxylic acid, reaction of carboxylic acids. Hell Volhard Zelinsky reaction.Synthesis of acid chlorides ester and amides reduction of carboxylic acids, mechanism of decarboxylation. Method of formation and chemical reaction of unsaturated monocarboxylic acid method of formation and effect of heat and dehydrating agents.
Ether: Nomenclature of ether and formation of ether Physical Property and chemical reaction, cleavage and auto oxidation, Ziesels method.

UNIT - V

Organic Compounds of Nitrogen: Preparation, properties and chemical reactions of nitroalkanes and nitroarenes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic neutral and alkaline media. Halonitroarenes; structure and nomenclature, and their activity.Amines structure, and nomenclature, physical properties and stereochemistry, separation of mixture of primary, secondary and tertiary amines.Structural features affecting basicity of amines. Amine salts as phase transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds, Gabriel phthalamide reaction, Hoffmann bromamide reaction, Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid synthetic transformation of aryl diazonium salts, azo coupling

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Class B.Sc. (II) Year Paper: Practical ***Maximum Marks: 50***

Duration of Practical Exam - 6 hours

Physical Chemistry	:	12 marks
Organic Chemistry	:	12 marks
Inorganic Chemistry	:	12 marks
Viva	:	06 marks
Sessional	:	08 marks

Practicals Introduced

1. To weigh a given compound on the physical balance and calculate the percentage error.
2. To calibrate pipette using distil water.
3. To calibrate a burette using distil water.
4. To prepare N/20 Oxalic acid solution in 250 ml and calculate the normality of unknown acid.
5. To investigate the heating and cooling curve of water.
6. Estimation of alkali content in antacid tablet.

Physical Chemistry

1. To determine the heat of neutralization and the total heat change of a strong acid and strong base using calorimeter.
2. Verification of Beer-Lambert's law and to determine the strength of a unknown solution by colorimeter.

Organic Chemistry

1. To Separate Sudan red and methyl orange dyes using thin layer chromatography (TLC).
2. To separate the pigments present in green leaves (spinach) by TLC and determine their Rf Values.
3. To separate and identify amino acids by paper chromatography.
4. Identification of an organic compound systematically.

Inorganic Chemistry

1. To determine the percentage of acetic acid in commercial vinegar.
2. To determine the hardness of water by complexometric titration using EDTA
3. Estimation of Fe(II) in Mohr's salt solution using standard KMnO4 solution via Redox titration.
4. To determine the strength (in g/L) of ferrous ammonium sulphate (FeSO4.(NH4)2SO4. 6H2O) by titrating it against standard potassium dichromate (K2Cr2O7) solution.
5. Analysis of inorganic mixture containing five radicals with atleast one interfering radical.

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Class B.Sc. (III) Year Paper – I (Physical Chemistry) ***Maximum Marks: 29***

UNIT - I

(A)Elementary Quantum Mechanics:

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

Dual nature of matter, 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.

(B) 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 levels from wave functions, physical picture of bonding and anti-bonding wave functions. Concept of **σ, σ*,**π π* orbital and their characters. Hybrid orbital-sp, sp2, sp3; calculation of coefficients of A.O's used in these hybrid orbital. Introduction to valence bond model of H_2 ion, comparison of M.O. and V.B. models

UNIT – II

(A)Spectroscopy:

Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers.Statement of the Born-Oppenheimer approximation. Degrees of freedom.

Rotational Spectrum: Diatomic molecules.Energy levels of spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effects.

Vibrational Spectrum: Infra-red spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant qualitative relation of force constants and bond energies, effects of an harmonic motion and isotope on the spectrum. Idea of vibrational frequencies of different functional groups.

UNIT – III

(A)Raman Spectrum

Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules. Selection rules.

(B)Electronic Spectrum: Concept of potential energy curves for bonding and anti-bonding molecular orbital qualitative description of selection rules and Franck-Condon principle.

Qualitative description of **σ,** π and n M.O. their energy levels and the respective transition.

(C)UV Spectroscopy: ***Instrumentation***, Electronic excitation, elementary idea of instrument used, Application to organic molecules. Woodward-Fieser rule for determining λ_{max} of enes, polyenes and α, β - unsaturated carbonyl compounds.

UNIT – IV

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes.

Laws of photochemistry: Grotthus-Draper law, Stark-Einstein law, Beer-Lambert law. Electronic transitions, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non radioactive process (internal conversion, inter system crossing), Quantum yield, photosensitized reactions energy transfer processes (simple examples.) Photochemical reaction of simple organic compounds, Norrish Type-I and Norrish Type-II reaction, ***Application of Fluorescence, Phosphorescence.***

UNIT – V

Physical Properties and Molecular Structure:

Optical activity, Polarization (Clausius Mossotti equation) orientation of dipoles in an electric field dipole moment, induced dipole moment measurement of dipole moment, temperature method and refractive method, dipole moment and structure of molecules, magnetic properties paramagnetism, diamagnetism and ferromagnetism.

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Class B.Sc. (III) Year Paper – II (Inorganic Chemistry) ***Maximum Marks: 28***

UNIT – I

(A)Hard and Soft Acids and Bases

Introduction Classification of acids and bases as hard and soft, Hard and soft acid-base concept of Pearson. Application of hard-acid-base theory Symbiosis, acid base strength and hardness and softness, Theoretical basis of hardness and softness, electronic theory , pie bonding theory and Drago Wayland theory, electro negativity and hardness and softness, limitation of hard soft acid base concept.

(B) Siliconses and Phosphazenes

Introduction: silicones-methods of preparation, classification, properties and application (uses). Phosphazenes(phosphonitrilic chloride)-methods of preparation and properties: structure of triphosphazenes. Some other phosphazenes and uses of phosphazenes.

UNIT-II

(A)Metal ligand bonding in transition metal complexes.

Introduction: Limitations of valence bond theory, crystal field theory, crystal field splitting of d-orbitals,d- orbital splitting and stabilisation energy in octahedral,tetrahedral and square planar complexes ; factors affecting the crystal field parameters. Applications of crystal field theory and limitations of crystal field theory.

(B).Thermodynamic and kinetic aspects of metal complexes

Introduction: thermodynamic aspects of metal complexes. Factors affecting thermodynamic stability of complexes. kinetic aspects of metal complexes. Stabilisation reactions of square planar complexes and factor affecting the rate of substitution reactions in square planar complexes.

UNIT-III

Magnetic properties of transition metal complexes: Introduction: types of magnetic behaviour. Diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, ferrimagnetism, origin and calculation of magnetism. Methods of determining magnetic susceptibility-Guoy, Bhatnagar Mathur, Quincke's, Curie and nuclear magnetic resonance method. Magnetic moment; L-S coupling, determination of ground state term symbol. Correlation of μ_s and μ_{eff} values. Orbital contribution magnetic moment and application of magnetic moment data for 3d metal complexes.

UNIT-IV

A. Electronic spectra of transition metal complexes:

Introduction: types of electronic transition selection rules for d-d transition ,spectroscopic ground state and Spectroscopic ground states in complexes; spectrochemical series ;orgel energy level diagram uses in octahedral and tetrahedral complexes having d^1-d^9 states: electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. Complexes with aromatic systems

Synthesis, structure and bonding in metal olefin complexes : alkyne complexes, cyclopentadienyl, complexes, coordinative unstauration, oxidative addition reaction, insertion reactions, fluxional molecules and their characterization compounds with metal-metal bond and metal atom clusters

UNIT-V

(A)Bioinorganic chemistry

Introduction: Essential and trace elements in biological processes, biological function of bio-elements. Availability of bio metals and bio non-metals, metallo porphyrins. Haemoglobin: structure and biological function. Myoglobin mechanism of oxygen transfer through haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca^{2+} nitrogen fixation.

(B) Metal Nitrosyl Complex: Nitrosylating agents. Synthesis, structure, Properties and Bonding

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Class B.Sc. (III) Year Paper – III (Organic Chemistry) ***Maximum Marks: 28***

UNIT – I

Spectroscopy: Nuclear Magnetic Resonance Spectroscopy: Proton Magnetic Resonance (1HNMR) spectroscopy, , Nuclear Shielding and dis-shielding, chemical shift and molecular structure, spin spin coupling and coupling constant, region of signals explanation of PMR spectra of simple organic molecule like ethyl bromide, ethanol, acetaldehyde,1,1,2 tribromo ethane, ethyl acetate, toluene and acetophenone. Application of UV, IR, PMR spectroscopy for simple organic compound.

UNIT – 2

***(A).*Organometallic compounds.**

Organo magnesium Compound, Grignard Reagent preparation, structure and chemical reactions Organo Zinc Compound –preparation and chemical reaction Organolithium Compounds-preparation, and chemical reaction.

(B).Organo sulphur compounds-nomenclature, structure characterstics. Thiol, thio-ether,sulphonic acid, sulphanomide and sulphaguanidine-method of preparations and chemical reaction.

(C) Organic Synthesis by Enolates: Acidity of hydrogen, alkylation of diethyl malonate and ethyl acetoacetate, synthesis of ethyl acetoacetate-claisen condensation. Keto-enol tautomerism in ethylacetoacetate. Alkylation of1,3 dithiane. Alkylation and acetylation of enamine

UNIT - III

(A) Carbohydrates-I: Classification and nomenclature, monosaccharide, mechanism of osazone formation, inter conversion of glucose into fructose, ascending and descending series in aldose configuration of monosaccharide, stereo isomers of erythro, threo sugars. Conversion of glucose into manose. Glycosidic linkage. determination of the size of the ring of monosaccharides. Ring structure of D (+) glucose, mechanism of mutation. Structure of ribose and deoxyribose. Disaccharides-introductory idea of maltose, sucrose and lactose(excluding structure) polysaccharides introductory idea of starch and cellulose(excluding structures).

(B)Elementary idea of Fats, Oils & Detergents :

Natural fats, edible and industrial oils of plant origin, normal fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Synthetic detergents- Alkyl and aryl sulphonates.

UNIT – IV

(A) Amino acids :

Amina acids, peptide, protein and nucleic acid : Classification, of amino acid structure and , stereochemistry, acid base behaviour, isoelectric point and electrophoresis, preparation and chemical reaction properties of α-amino acids. Nomenclature and structure of peptides and Proteins. Classification, of protein determination of peptide structure end group analysis, selective

analysis of peptides, peptide synthesis, solid phase peptide synthesis Structure of peptide and proteins: Level of protein structure, denaturation of protein

Nucleic acids: constitution of nucleic acids, Ribonucleosides and Ribonucleotides. Double helical structure of DNA.

(B) Synthetic Dyes:: Colour and constitution (electronic concept) Classification of dyes- Methyl orange, Congored, Malachite green, Crystal violet, Phenolphthalein ,Fluoroscein Alizarine and Indigo-Chemical study and synthesis.

UNIT – V

Heterocyclic Compounds:

Introduction of pyrrole, furan, thiophene, and pyridine: Aromatic character and molecular orbital picture, methods of synthesis and specific chemical reactions with reference to electrophilic substitution. Reaction mechanism of nucleophilic substitution in pyridine derivatives. Comparison of basicity between pyridine, piperdine and pyrrole. Introductory idea about five and six membered condensed heterocyclic compounds. Indole, Quinoline and isoquinoline and isoquinoline – Preparations and chemical properties (Fischer-Indole synthesis, Skraup's synthesis, Bischler Napiaralsky Synthesis). Electrophilic substitution reactions of Indole, Quinoline and isoquinoline.

Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Under Graduate Yearly Syllabus as recommended by
Central Board of Studies and Approved by the Governor of M.P.
Chemistry Syllabus Session 2019-20

Class B.Sc. (III) Year Paper: Practical ***Maximum Marks: 50***

Duration of Practical Exam - 6 hours
Physical Chemistry : 12 marks
Organic Chemistry : 12 marks
Inorganic Chemistry: 12 marks
Viva : 06 marks
Sessional : 08 marks

Physical Chemistry

1. To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ethyl acetate catalysed by hydrogen ions at room temperature.
2. Determination of partition coefficient of iodine between carbon tetra chloride and water.
3. Job's method
4. pH-metric titration, conductometric titration.

Organic Chemistry

1. Binary mixture analysis containing two solids
   Sepration, identification and preparation of derivatives
2. Preparation
   (i) Acetylation (ii) Benzolyation (iii) Meta-dinitro benzene (iv) Picric acid

Inorganic Chemistry

1. Gravimetric analysis:
   Barium as Barium sulphate, Copper as cuprous-thiocynate.
2. Complex compound preparation
   (a) Potassium chlorochromate (IV)
   (b) Tetramine copper(II)sulphate monohydrate
   (c) Hexamminenickel (II) chloride
3. Effluent water analysis, identification of cations and anions in different samples.
4. Water analysis- To determine dissolved oxygen in water sample in ppm.

Viva ***:*** ***06 marks***