St. Aloysius (Autonomous) College, Jabalpur
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 2021-22

Class B.Sc. (III) Year Paper – I (Physical Chemistry) ***Maximum Marks: 27***
Minimum Marks: 10

Course outcome-

- To learn about the role of Elementary quantum mechanics its fundamental role in explaining how the world works.
- To apply the Basic concepts of forming Molecular Orbital theory ant its application.
- To develop an understanding of basic principle and applications of Rotational, Vibrational, Raman and Electronic Spectroscopy.
- To impart essential theoretical knowledge of fundamental concepts photochemistry and its laws.

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.Hamiltonianoperator.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-redspectrum: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}ofenes, 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, intersystemcrossing), 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 (ClausiusMossotti 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.

St. Aloysius (Autonomous) College, Jabalpur
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 2021-22

Class B.Sc. (III) Year Paper – II (Inorganic Chemistry) ***Maximum Marks: 27***
Minimum Marks: 09

Course outcome-

- To obtain concrete knowledge of Acid and bases theories and its applications.
- To gain an understanding about the limitations of valence bond theory and applications of crystal field theory
- To apply the concept of thermodynamic and kinetic aspects to metal complexes and magnetic properties of transition metal complexes
- To increase in-depth knowledge of Bioinorganic compounds and their properties.

UNIT – I

(A)Hard and Soft Acids and Bases

IntroductionClassification 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 DragoWayland 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, BhatnagarMathur,Quincke's, Curie and nuclear magnetic resonance method.Magneticmoment;L-Scoupling,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.Availabilityof bio metals and bio non-metals, metalloporphyrins. Haemoglobin:structureand 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.

Metal ions in biological systems and their role in ion transport across the membrane (molecular mechanism), oxygen uptake proteins, cytochrome and ferrodoxins

St. Aloysius (Autonomous) College, Jabalpur
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 2021-22

Class B.Sc. (III) Year Paper – III (Organic Chemistry) ***Maximum Marks: 26***
Minimum Marks: 09

Course outcome-

- Acquire conceptual knowledge of Nuclear Magnetic Resonance Spectroscopy and its applications.
- The gain knowledge about organometallic compounds and their synthesis.
- To develop both theoretical and experimental knowledge about Carbohydrates, Fats, Oils & Detergents**,** Amino acids, Nucleic acids **and** Synthetic Dyes:

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 signalsexplanation of PMR spectra of simple organic molecule like ethyl bromide,ethanol,acetaldehyde,1,1,2 tribromoethane, ethylacetate, 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). Organosulphur compounds-nomenclature,structure characterstics. Thiol,thio-ether, sulphonicacid, sulphanomide and sulphaguanidine-method of preparations and chemical reaction.

(C) Preparation and Properties of Polymers: Organic polymers-Polyethene, polystyrene, polyvinyl chloride, teflon, nylon, terylene, and natural rubber and synthetic rubber.

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. Glycosidiclinkage.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.

UNIT – V

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

Pericyclic Reactions: Classification and Example wood ward Hoffmann rule, Electro cyclic reaction , cyclo addition reaction (2,2 and 4,2 and sigmatropic shift (1.3.3,3 and 1,5 FMO) approach.