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

Course MCH 101
Inorganic Chemistry

UNIT I

Stereochemistry and Bonding in Main Group Compounds. VSEPR theory and its application for treating structures of inorganic molecules and ions containing lone pairs of electrons, shortcomings of VSEPR model. MO treatment of polyatomic molecules, e.g., ozone, nitrite, nitrate, hydarzoic acid and benzene.

UNIT II

Metal-Ligand Bonding . Molecular orbital theory. Qualitative aspects of metal-ligand sigma-bonding in octahedral, tetrahedral and square planar complexes. Jahn-Teller Effect

Electronic Spectra and of Transition Metal Complexes. Spectroscopic term, terms and microstates for the p^2 and d^2 configurations, Hund's rules for ground state terms, the correlation of spectroscopic terms into Mulliken symbols, electronic transition selection rules, Orgel diagrams for transition metal complexes (d^1-d^9 states). Jahn-teller effect and electronic spectra of complexes

UNIT III

Metal-Ligand Equilibria in Solution. Stepwise and overall formation constants and their relationship, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by Bjerrum method , Job's and Mole ratio methods.

UNIT IV

Reaction Mechanism of Transition Metal Complexes I. Inert and labile complexes, interpretation of lability and inertness of transition metal complexes on the basis of valence bond and crystal field theories. Kinetics of octahedral substitution: acid hydrolysis, factors affecting acid hydrolysis.

UNIT V

Reaction Mechanism of Transition Metal ComplexesII. Base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism. Substitution reactions in square planar complexes: The *Trans* effect and the *trans* influence: Polarization and Pi-Bonding theories, applications of *Trans* effect in synthesis, Kurnakove's test of distinguishing *cis* and *trans* isomers using the concept of trans effect, mechanism of substitution reactions in square planar complexes, factors affecting substitution reactions. Acquaintance of *Trans* effect in octahedral complexes

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

Course MCH 102

Organic Chemistry

UNIT I

Structure and Bonding. Bonding in organic molecules. Delocalized chemical bonding-conjugation, cross conjugation, Conjugation, resonance, hyperconjugation.

Aromaticity in benzenoid and non-benzenoid compounds, alternate and non-alternate hydrocarbons. Hűckel rule, anti-aromaticity, homo-aromaticity.

Bonds weaker than covalent bond. Hydrogen bonding, crown ether complexes, and cyclodextrins

UNIT II

*Stereochemistry. C*hirality, elements of symmetry, molecules with more than one chiral center, threo and erythro isomers. R and S configuration. Separation of enantiomers. Regioselective, stereospecific and stereoselective rections. Asymmetric synthesis. Optical activity in the absence of chiral carbon (atropisomerism)biphenyls, allenes and spiranes, and their nomenclature. Conformational analysis of cyclohexanes and decalins. Effect of conformation on reactivity

UNIT III

Reaction Mechanism. Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, and control, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects. Effect of structure on reactivity -resonance and field effects, steric effect. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation.

UNIT IV

Aliphatic Nucleophilic Substitution. The S_N2, S_N1, mixed S_N2 and S_N1, and SET mechanisms. The S_Ni mechanism. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium. The neighbouring group mechanism, neighbouring group participation by Pi and Sigma bonds. Classical and nonclassical carbocations, norbornyl system, carbocation rearrangements

UNIT V

Aromatic Nucleophilic Substitution. The S_NAr, S_N1, benzyne and $S_{RN}1$ mechanisms. Reactivity, effect of substrate structure, leaving group and attacking nucleophile. Bucherer reaction, alkylation, and amination. The Bamberger rearrangement. The von Richter rearrangement

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc. (I)
Course MCH 103
Physical Chemistry

UNIT I

Introduction to exact quantum mechanical results. The Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrodinger equation to systems such as particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom.

UNIT II

Approximate Methods. The variation theorem, linear variation principle. Perturbation theory (introductory idea). Application of variation method to the Helium atom.

Angular Momentum. Ordinary angular momentum, generalized angular momentum, eigen functions for angular momentum, eigen values of angular momentum, addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

UNIT III

Classical Thermodynamics. Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar properties; partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity.

Derivation of phase rule and its application to three component systems, second order phase transitions.

UNIT IV

Chemical Dynamics (Part I). Methods of determining rate laws, Arrhenius equation, collision theory of reaction rates, steric factor, activated complex theory, ionic reactions, kinetic and thermodynamic control of reactions.

UNIT V

Chemical Dynamics (Part II). Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and oscillatory reactions, homogeneous catalysis, kinetics of enzyme reactions

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc. (I)
Course MCH 104
Spectroscopy I

UNIT I

Unifying Principles. Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorption, emission, transmission, reflection, refraction, dispersion, polarisation and scattering. Uncertainty relation and natural line width and natural line broadening, transition probability, transition moment, selection rules, intensity of spectral lines.

UNIT II

Microwave Spectroscopy. Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field. Applications.

UNIT III

Infrared Spectroscopy. Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P,Q,R branches. Vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region.

UNIT IV

Raman Spectroscopy. Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle. Resonance Raman spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).

UNIT V

Electronic Spectroscopy Atomic Spectroscopy. Energies of atomic orbitals, vector representation of momenta and vector coupling, spectra of hydrogen atom and alkali metal atoms. *Molecular Spectroscopy.* Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radiative and non-radiative decay, internal conversion, charge-transfer spectra.

st. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc. (I)
Course MCH 105
Maths for Chemist and Computers

Unit I

Vectors. Vectors, dot, cross and triple products etc. gradient, divergence and curl, Vector Calculus. *Matrix Algebra.* Addition and multiplication; inverse, adjoint and transpose of matrices.

Unit II

Differential Calculus. Functions, continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc.). *Integral calculus.* Basic rules for integration, integration by parts, partial fractions and substitution. Reduction formulae, applications of integral calculus. Functions of several variables, partial differentiation, co-ordinate transformations (e.g. Cartesian to spherical polar).

Unit III

Elementary Differential equations. First-order and first degree differential equations, homogenous, exact and linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry etc. second order differential equation and their solutions.

Permutation and Probability. Permutations and combinations, probability and probability theorems average, variance root means square deviation examples from the kinetic theory of gases etc., fitting (including least squares fit etc with a general polynomial fit.

UNIT – IV

Chemistry and FORTRAN Programming: Introductory FORTRAN concepts, character set,constant variables, data types, subscripted variables, and FORTRAN functions. FORTRANexpressions and naming FORTRAN programme, assignment statements, FORTRAN commands.Data transfer and program execution control: Introduction, format specification for READ andWRITE statements, format commands, control commands and transfer commands

UNIT – V

Arrays and replitive computation; Introduction, arrays arrange storage, dimension statement, docomtruel, Nested do – loop continue statement, implied do. Sub – programme (functions and sub routines): Introduction, sub programme, functions in FORTRAN, function arguments, subroutines,save variable function vs. subroutine programme. Global variables and file manipulation:

Introduction, common statement, equivalence declaration, data command, block datasubprogramme, declaration external, character expression and assignment, the open and closedstatement, internal file, file 'input' and 'output'. Developing Linear Least – Squares fit programs in FORTRAN, as well as for involving simple formulae in organic, inorganic and

physical chemistry programs in FORTRAN, as well as for involving simple formulae in organic, inorganic and physical chemistry

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc. (I)
Course MCH 105
Biology for Chemist and Computers

Unit I

Cell Structure and Functions. Structure prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells. Overview and their functions, comparison of plant and animal cells. Overview of metabolic processes-catabolism and anabolism. ATP – the biological energy currency. Origin of life-unique properties of carbon chemical evolution and rise of living systems. Introduction to bio-molecules, building blocks of biomacromolecules.

Unit II

Carbohydrates. Conformation of monosaccharides, structure and functions of important derivatives of mono-saccharides like glycosides, deoxy sugars, myoinositol, amino sugars. Nacetylmuramic acid, sialic acid disaccharides and polysaccharides. Structural polysaccharides cellulose and chitin. Storage polysaccharides-starch and glycogen. Structure and biological function of glucosaminoglycans of mucopolysaccharides. Carbohydrates of glycoporteins and glycolipids. Role of sugars in biological recognition. Blood group substances. Ascorbic acid.

Unit III

Amino-acids, Peptides and Proteins. Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins. force responsible for holding of secondary structures. ahelix, -b-sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and domina structure. Quaternary structure. Amino acid metabolism-degradation and biosynthesis of amino acids, sequence determination, chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH).

UNIT – IV

Chemistry and FORTRAN Programming: Introductory FORTRAN concepts, character set,constant variables, data types, subscripted variables, and FORTRAN functions. FORTRANexpressions and naming FORTRAN programme, assignment statements, FORTRAN commands.Data transfer and program execution control: Introduction, format specification for READ andWRITE statements, format commands, control commands and transfer commands

UNIT – V

Arrays and replitive computation; Introduction, arrays arrange storage, dimension statement, docomtruel, Nested do – loop continue statement, implied do. Sub – programme (functions and sub routines): Introduction, sub programme, functions in FORTRAN, function arguments, subroutines,save variable function vs. subroutine programme. Global variables and file manipulation:

Introduction, common statement, equivalence declaration, data command, block datasubprogramme, declaration external, character expression and assignment, the open and closedstatement, internal file, file ‘input’ and ‘output’. Developing Linear Least – Squares fit

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc(II) Semester
Course MCH 201
Inorganic Chemistry

UNIT I

*Reaction Mechanism of Transition Metal Complexes III. :*Substitution reaction without Metal – Ligand bond cleavage. Oxidtion reduction reactions throughgroup transfer, through electron transfer, Innersphere and outersphere mechanism, 2 electron transfer reactions, Distinguish between Innersphere and Outersphere, factors affecting electron transfer reaction, Marcus –Hush theory

UNIT II

Metal Pi-Complexes. Metal carbonyls: structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation. Dioxygen complexes, Wilkinson's catalyst

UNIT III

Borane Chemistry Metal Clusters. Bonding and topology of boranes, 4-digit coding (s, t, y, x) numbers for B_2H_6, B_4H_{10}, B_5H_9, B_5H_{11} and B_6H_{10} and their utilities. Acquaintance with carboranes and metallocarboranes. Metal clusters: synthesis, reactivity and bonding.

UNIT IV

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Electronic Spectra and Magnetic Properties of Transition Metal Complexes. Calculations of Dq, B and parameters for Cr(III), Co(II) and Ni(II) complexes using electronic spectral data. Charge transfer spectra: ligand to metal and metal to ligand.

UNIT V

Metal Pi-Complexes. Metal nitrosyls: Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and x-ray diffraction studies of metal nitrosyls for bonding and structure elucidation, important reactions of transition metal nitrosyl complexes pertaining to potentiality in air pollution control, biomedical applications. Dinitrogen complexes, Vaska's compound

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

Course MCH 202

Organic Chemistry

UNIT I

Free Radicals. Free radical reactions and their stereochemistry. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, hydroperoxide formation, replacement of diazonium group. Hunsdiecker reaction.

UNIT II

Addition to Carbon-Carbon Multiple Bonds. Mechanistic and stereochemical aspects of addition reactions. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation. *Addition to Carbon-Hetero atom Multiple Bonds.* Mechanism of metal hydride reduction of carbonyl compounds, acids, esters and nitriles. Wittig reaction. Mechanism of condensation reactions involving enolates. Mannich, Benzoin, Perkin, and Stobbe reactions.

UNIT III

Elimination Reactions. The E2, E1 and E1cB mechanisms and their spectrum. Orientation of the double bond. Reactivity, effect of substrate structure, attacking base, the leaving group and the medium. Elimination *versus* substitution. Mechanism and orientation in pyrolytic elimination. The Hofmann degradation. Dihalo-elimination. Decomposition of toluene-p-sulphonylhydrazones. Conversion of ketoximes to nitriles. *N*-Nitrosoamine to diazoalkane transformation

UNIT IV

Pericyclic Reactions: Part I. Molecular orbitals and their symmetry. Molecular orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system, and their symmetry properties.

Pericyclic reactions. Characteristics and classification. Electrocyclic reactions: conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Woodward-Hoffmann correlation diagrams. FMO and PMO approach.

UNIT V

Pericyclic Reactions: Part II. Cycloaddditions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Antarafacial and suprafacial additions. 4n and 4n+2 systems, 2+2 addition of ketenes. Ene synthesis.

Sigmatropic Rearrangements. Suprafacial and antarafacial 1,3- and 1,5- shifts of H, sigmatropic shifts involving carbon moieties, 2,3-, and 3,3-sigmatropic rearrangements. Claisen, Cope, aza-Cope, Sommlet-Hauser, and Fisher Indole rearrangements.

Department of Chemistry

According to the Department of Higher Education, Govt. of M.P.

Chemistry Syllabus Session 2019-20

M.Sc(II) Semester

Course MCH 203

Physical Chemistry

UNIT I

Chemical Dynamics(Part III). General features of fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method. Dynamics of molecular motions and of barrierless chemical reactions in solution, probing the transition state. Dymanics of unimolecular reactions; Lindemann-Hinshelwood and Rice-Ramsperger-Kassel-Marcus and Slater theories of unimolecular reactions.

UNIT II

Adsorption. Surface tension, capillary action, pressure difference across curved surface, Laplace equation, vapour pressure of droplets, Kelvin equation; Gibbs adsorption isotherm. Multilayer adsorption, BET equation. Calculation of surface area, catalytic activity at surfaces. Surface films on liquids; electrokinetic phenomena; surface active agents. Micellisation, hydrophobic interaction. Critical micellar concentration. Solubilisation. Donnan's membrane equilibria.

UNIT III

Electrochemistry of solutions. Debye-Huckel -Onsager treatment and its extension to concentrated solutions. Ion size factor and ion-solvent interactions. Concept of activity. Determination of mean ionic activity and activity coefficient. *Lippmannn electrocapillary phenomenon.* Electrocapillary curves of mercury and their interpretation. Structure of electrified interfaces. Helmholtz, Guoy and Chapmann and Stern models. Introductory idea of advancements in electrified surfaces. Electrokinetic potential, its determination and significance.

UNIT IV

Irreversible electrode phenomenon. Decomposition voltage and overvoltage. Consecutive electrode processes. Exchange current density. Butler-Volmer's equation. Tafel's plot. Theory of polarography. Ilkovic equation. Half wave potential and its significance.
Introduction to corrosion. Forms of corrosion. Corrosion monitoring and prevention

UNIT V

Applied ElectrochemistryElectrochemistry: Nernst equation, electrode kinetics, electrical double layer, Debye-Huckel theory. Voltammetry, Current voltage relationship, Characteristic of DME, Half wave potential. Amperometric titrations.
Corrosion: Introduction to corrosion, forms of corrosion, corrosion monitoring and prevention methods.

St. Aloysius College, Jabalpur

Department of Chemistry

According to the Department of Higher Education, Govt. of M.P.

Chemistry Syllabus Session 2019-20

M.Sc(II) Semester

Course MCH 204

Spectroscopy II

UNIT –I

Infrared and Raman Spectroscopy. Instrumentation and sample handling. Calculation of vibrational frequencies. Characteristic vibrational frequencies of alkanes, alkenes, alkynes, carbonyl compounds, alcohols, ethers, amines, phenols and aromatic compounds. Finger-print region. Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance. FT-IR.

Resonance Raman effect. Concept and factors that influence group frequencies

UNIT- II

Electronic Spectroscopy and its applications. Electromagnetic radiation, wavelength, wave number, frequency, and energy calculation. Electronic transitions (185-800 nm), Beer-Lambert law, effect of solvent on electronic transitions, Fieser-Woodward rules for conjugated dienes and carbonyl compounds. *Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD).* Concept of ORD and CD, deduction of absolute configuration, octant rule for ketones.

UNIT -III

Nuclear Magnetic Resonance Spectroscopy. ^{1}H-NMR phenomenon. chemical shift, shielding and deshielding mechanism, mechanism of measurement, chemical shift values and its correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercapto). Chemical exchange, effect of deuteration. Spin-spin coupling (first order spectra; AX, AB, AMX spectra). Coupling constant, Karplus curve. Complex spin-spin interactions. Simplification of complex spectra, nuclear magnetic double resonance, increased field strength, contact shift reagents. Nuclear Overhauser effect (NOE). FT technique.

Nuclear Magnetic Resonance Spectroscopy. *NMR Shift reagents, shift mechanism and its utility in simplification of NMR spectra. Applications of NMR in characterization of coordination compounds*

UNIT -IV

Electron Spin Resonance Spectroscopy. Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the g value. Hyperfine coupling. Double resonance in esr. Spin Hamiltonian relationship, measurement techniques, applications.

UNIT- V

Photoelectron Spectroscopy. Basic principles; photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. Auger electron spectroscopy -basic idea. *Photoacoustic Spectroscopy.* Basic principles of photoacoustic spectroscopy (PAS), chemical and surface applications

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

M.Sc(II)

Course MCH 205 Elective
Course MCH 205 A Analytical Chemistry

UNIT I

Statistical Analysis. Emphasis should be placed on numerical problems. Significant figures. Accuracy and precision. Errors, systematic and random errors. Propagation of errors. Standard deviation. Coefficient of variation. Confidence limit. Significance test. t-Test, F-Test. Rejection of a result. The least-squares method for deriving calibration graph. Correlation coefficient. Limit of detection.

Sample Preparation for Chromatography. Solid-phase extraction, solid-phase microextraction. Extraction with molecular imprinted polymers.

UNIT II

Chromatography. Theory of Chromatography. Retention time. Capacity factor. Number of theoretical plates, and plate height. Band broadening. van Deemter equation. Column resolution. *Gas Chromatography.* Instrumentation. Columns. Detection: flame ionisation detector, thermal conductivity detector and mass spectrometric detector.
High-Performance Liquid Chromatography. Instrumentation. Pumping systems. Sample injection system. Columns. Detection: UV-Vis detector, photodiode array detector, fluorescence detector, refractive index detector and mass spectrometric detection. *Capillary Electrophoresis.* Principle, modes of operation, and instrumentation.

UNIT III

Ion Exchange. Cation and anion exchangers. Action of ion exchange resins. Ion exchange equilibria and ion exchange capacity. Strongly and weakly acidic cation exchangers. Strongly and weakly basic anion exchangers. Liquid ion exchangers. Ion chromatography. Conductivity detection using suppressor column. *Solvent Extraction.* The distribution coefficient. Factors favouring solvent extraction. Extraction reagents. Synergetic effects. Ion-pair extraction. Extraction and stripping. Solvent extraction with crown ethers, and factors influencing it.

UNIT IV

Atomic Absorption Spectrometry. Principle. Instrumentation. Flame atomization. Hollow-cathode lamps. Inductively coupled plasma-mass spectrometry. *Electrolytic Methods.* Fundamentals of the techniques: Voltammetry. Polarography. Differential pulse polarography. Cyclic voltammetry. Anodic stripping analysis.

UNIT V

Acid-Base Titrations. Kjeldahl method for determination of nitrogen. Determination involving acetylation (amino and hydroxyl groups); and oximation (carbonyl group). *Precipitation Titrations.* Argentometric titrations. Mohr titration. Volhard titration. Fajan

titration. *Complexometric Titrations.* Titration with EDTA. Indicators for EDTA titrations. Titration methods: direct and back titrations, and displacement methods. Masking and demasking .agents, and their use in EDTA titrations Redox Titrations. Determination of 1,2-diols by periodate oxidation. Karl Fischer titration of water. Determination of DO,BOD and COD.

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

Course MCH 205 Elective

MCH 205 B Photochemistry

Unit-I

Photochemical Reactions. Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

Unit II

Determination of Reaction Mechanism. Classification, rate constants and life times of reactive energy state determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photo dissociation, gas-phase photolysis.

Unit III

Photochemistry of Alkene. Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes.

Photochemistry of Aromatic Compounds. Isomerisations, additions and substitutions.

Unit IV

Photochemistry of Carbonyl Compounds. Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, unsaturated and α,β-unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.

Unit V

Miscellaneous Photochemical Reactions. Photo-Fries reactions of annelid's, Photo-Fries rearrangement. Barton reaction. Singlet molecular Oxygen reaction. Photochemical formation of smog. Photodegration of polymers. Photochemistry of vision.

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

M.Sc(III)

Course MCH 301
Inorganic Chemistry

UNIT I

Group Theory. Symmetry elements and symmetry operations, symmetry groups or point groups, Schoenflies symbols, point group classifications, matrix representation of symmetry operations, group, necessary conditions for any set of elements to form a group, subgroups, classes in a group

UNIT II

Group theory and vibrational Spectroscopy. *Group theory to symmetry, shapes and molecular energy level diagrams of molecules like BF_3, NH_3 (AB_3 type), $[Pt(NH_3)_4]^{2+}$, $[Ni(CN)_4]^{2-}$ (AB_4 type) and $[Co(NH_3)_6]^{3+}$ (AB_6 type) molecules. Modes of bonding of ligands such as SCN^-, □-ketoenolate and related ligands, nitrate ion and corboxylates*

UNIT-III

Application of group theory to Spectroscopy. Use of group theory in predicting IR and Raman active modes in some simple molecules of C_{2v}, C_{3v} and $D_{□h}$ point groups.

UNIT IV

Electron Spin Resonance Spectroscopy. Basic principles, hyperfine and superhyperfine splitting, g value and factors affecting g values, applications to transition metal complexes.

UNIT V

Mössbauer Spectroscopy. Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds -nature of M-L bond, coordination number, structure and (3) detection of oxidation state

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc(III)
Course MCH 302
Physical Chemistry

UNIT I

Electronic Structure of Atoms. Electronic configuration, Russell-Saunders terms and coupling scheme, Slater parameters, magnetic effects. Zeeman splitting; virial theorem.

UNIT II

Molecular Orbital Theory. Hückel theory of conjugated systems, bond order and charge density calculations. Applications to ethylene, butadiene, and cyclobutadiene. Introduction to extended Hückel theory.

UNIT III

Homogeneous Catalysis. Stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerisation of olefins.
Heterogenous Catalysis. Thermodynamics of active centres, mechanism of heterogenous catalysis; structural promotion and structural modification.

UNIT IV

Crystal Defects. Perfect and imperfect crystals, stoichiometric and non-stoichiometric defects. Intrinsic and extrinsic defects, point defects, line and plane defects; Schottky and Frenkel defects.
Solid State Reactions. General principles, coprecipitation as a precursor to solid state reactions, factors affecting solid state reactions.

UNIT V

Electronic Properties and Band Theory. Metals, insulators and semiconductors. Electronic structure of solidsBand theory; band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors.

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

M.Sc(III)

Course MCH 303

Spectroscopy III

UNIT I

^{13}C-NMR Spectroscopy General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), wide band H-decoupled and off-resonance H-decoupled spectra. Calculation of chemical shift values for alkanes and substituted benzene.Two dimension NMR spectroscopy. COSY, and DEPT techniques. *Conjoint Spectroscopy Problems.* Application of UV, IR, Raman, NMR and Mass spectrometry for elucidation of structure of organic compounds.

UNIT II

Mass Spectrometry-Part I. Ion production, electron ionisation (EI), chemical ionisation (CI), field desorption (FD), field ionisation (FI), and fast atom bombardment (FAB). Atmospheric pressure ionisation techniques. Electrospray ionisation, and atmospheric pressure chemical ionisation. Thermospray ionisation. Matrix assisted laser desorption ionisation (MALDI). Mass analysers. Magnetic sector analysers. Quadrupolar analysers, ion trap, time-of-flight (TOF), ion cyclotron resonance (ICR). Electron multiplier. Tandem mass spectrometry (MS/MS).

UNIT III

Mass Spectrometry-Part II. Isotopic abundance. Electron ionisation and fragmentation (positive ions). Molecular ion peak, metastable peak. McLafferty rearrangement. Nitrogen rule. Parity rule. Mass spectral fragmentation of organic compounds containing common functional groups (alkanes, alkenes, alkynes, halo-compounds, alcohols, amines, carbonyl compounds, aromatic compounds).

High resolution mass spectrometery. Interpretation of mass spectra. Problems based on mass spectrometry of organic compounds.

UNIT IV

X-ray Diffraction. Bragg condition, Miller indices, Laue method, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density. Description of the procedure for an X-ray structure analysis.

UNIT V

Electron Diffraction. Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces.

Neutron Diffraction. Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell.

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

M.Sc(III)

Course MCH 304 Elective
Course MCH 304 A Medicinal Chemistry

Unit I

Structure and activity. Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.

Unit II

Pharmacodynamics. Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

Unit III

Antibiotics and antibacterials. Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular . Streptomycin, Broad spectrum antibiotics . Tetracyclines, Anticancer – Dactinomycin (Actinomycin D)

Unit IV

Antifungal polyenes, Antibacterials. Ciprofloxacin, Norfloxacin, Antiviral. Acyclovir Antimalarials. Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine

Unit V

Non-steroidal Anti-inflammatory Drugs. Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthmatic agents : Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc(III)
Course MCH 304 Elective
Course MCH 304 B Chemistry of Natural Products

UNIT I

Terpenoids. General methods of structure elucidation. Isoprene rule.
Structure determination, stereochemistry, and synthesis of the following representative molecules: citral, geraniol, α-terpineol, menthol, α-pinene, camphor, and abietic acid. Biosynthesis of terpenoids.

UNIT II

Alkaloids. General methods of structure elucidation.
Structure determination, stereochemistry, and synthesis of the following representative molecules: ephedrine, nicotine, atropine, quinine and morphine. Biosynthesis of alkaloids.

UNIT III

Steroids. Structure elucidation, stereochemistry and chemical synthesis of cholesterol, bile acids, androsterone, testosterone, estrone, progestrone and aldosterone. Biosynthesis of steroids.

UNIT IV

Plant Pigments. Carotenoids. Structure and synthesis of β-carotene.
Flavonoids. Nature, general methods for structure elucidation and synthesis of anthocyanins and flavones. Structure and synthesis of cyanidin chloride, cyanin, flavone, flavonol and quercetin. Biosynthesis of flavonoids.*Chlorophyll.* Chemistry of chlorophyll.

UNIT V

Vitamins and Antibiotics. Vitamins. Structure and synthesis of vitamin B_1 (thiamine), B_2 (riboflavin) and B_6 (pyridoxine). Chemistry of Vitamin B_{12}.
Antibiotics. Structure and synthesis of penicillins and chloramphenicol.

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

M.Sc(III) Semester
Course MCH 304 Elective

MCH 304 C Polymers

UNIT I

Basics of Polymers. Repeating units, degree of polymerisation, linear, branched and network polymers. Classification of polymers. Addition, radical, ionic, coordination and condensation polymerisation; their mechanism and examples.
Polymerisation conditions and polymer reactions. Polymerisation in homogeneous and heterogeneous systems.

UNIT II

Polymer Characterisation. Significance of molecular weight of polymer. Polydispersive average molecular weight. Number, weight and viscosity average weights. Measurement of molecular weights. End group, viscosity, light scattering, osmotic and ultracentrifugation methods.
Chemical and spectroscopic analysis of polymers. X-Ray diffraction study. Thermal analysis, tensile strength, fatique, impact. Tear resistance. Hardness and abrasion resistance.

UNIT III

Structure and Properties. Configuration of polymer chains. Crystal structure of polymers. Morphology of crystalline polymers. Polymer structure and physical properties; crystalline melting point Tm, melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Tg relationship between Tm and Tg, effects of molecular weight, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization.

UNIT IV

Polymer Processing. Plastics, elastomers and fibres. Compounding. Processing techniques, Calendering, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moudling, thermoforming, foaming, reinforcing and fibre spinning.

UNIT V

Properties of Polymers. Properties of polyethylene, polyvinyl chloride, polyamides, polyesters,phenolic resins, epoxy resins and silicone polymers.Functional polymers. Fire retarding polymers, and electrically conducting polymers.Biomedical polymers. contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

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St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
Chemistry Syllabus Session 2019-20
M.Sc(IV) Semester
Course MCH 401
Inorganic Chemistry

Unit-I

Organic Reagents in Inorganic Chemistry: Chelation, factors determining the stability of chelates (effect of ring size, oxidation state of the metal, coordination number of the metal); Use ofthe following reagents in analysis:

(a) Dimethylglyoxime (in analytical chemistry)
(b) EDTA (in analytical chemistry)
(c) 8-Hydroxyquinoline (in analytical chemistry)
(d) 1,10-Phenanthroline (in analytical chemistry)
(e) Thiosemicarbazones (in analytical chemistry)
(f) Dithiazone (in analytical chemistry)

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UNIT II

Bioinorganic Chemistry. Metal containing enzymes: Carboxypeptidase-A, Carbonic anhydrase, arginase, urease, DNA polymerase, phosphoglucomutase (glucose storage): structure and reactivity

UNIT III

Bioinorganic Chemistry: Metal complexes in transmission of energy: Chlorophylls, photosystem-I and photosystem-II in cleavage of water, model systems.

UNIT IV

Electron Transfer in Biology: Structure and function of metalloproteins in electron transport processes-cytochromes and ion-sulphur proteins. Nitrogenase: Biological nitrogen fixation, molybdenum nitrogenase-structure and function.

UNIT V

Transport and Storage of Di-oxygen Structure and function of haemoglobin, myoglobin, hemocyanin and hemertyin. Poisoning towards haemoglobin and myoglobin.

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

M.Sc(IV) Semester
Course MCH 402

Organic synthesis strategies

UNIT I

Oxidation. Oxidation of carboncarbon double bond. Perhydroxylation, potassium permanganate, osmium tetroxide, iodine together with silver carboxylates, ozonolysis. Enantioselective epoxidation of allylic alcohols (Sharpless epoxidation). Oxidation of alcohols. Chromic acid, chromiun (VI) oxide-pyridine complexes, manganese (IV) oxide, silver carbonate, oxidation via alkoxysulphonium salts. Baeyer-Villiger oxidation of ketones. Oxidation with ruthenium tetroxide, thallium(III) nitrate and iodobenzene diacetate.

UNIT II

Reduction. Catalytic hydrogenation (homogeneous and heterogenous). Stereochemicstry and mechanism, selectivity of reduction.

Reduction by dissolving metals. Metal and acid, metal and alcohol, metal and ammonia.

Reduction by hydride-transfer reagents. Aluminium alkoxides, lithium aluminium hydride, sodium borohydride, lithium hydrido-alkoxyaluminates.
Wokff-Kishner reduction. Reduction with di-imide

UNIT III

Designing organic synthesis. The Disconnection Approach. Basic principles, synthons, functional group interconversions. Order of events in organic synthesis. One group CX disconnections and two group CX disconnections. Chemoselectivity. Reversal of polarity (umpolung). Amine synthesis

UNIT IV Organic reagent
Organic Reagents: Reagents in organic synthesis: Willkinson catalyst, Lithium dialkyl cuprates (Gilman's reagents), Lithium diisopropylamide (LDA), 1,3-Dithiane (Umpolung)
Dicyclohexylcarbobiimide (DCC), and Trimethylsilyliodide, DDQ, SeO2, Baker yeast, Tri-nbutyltinhydride, Nickel tetracarbonyl, Trimethylchlorosilane

UNIT V Rearrangment
General mechanistic considerations-nature of migration, migratory aptitude,
memory effects. A detailed study of the following rearrangements: Benzil-Benzilic acid, Favorskii,Arndt-Eistert synthesis, Neber, Backmann, Hofmann, Curtius, Schmidt, Benzidine, Baeyer-Villiger, Shapiro reaction, Witting rearrangement and Stevens rearrangement

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

M.Sc(IV) Semester
Course MCH 403 A Departmental Elective

Environmental Chemistry

Unit I

Environment
Introduction. Composition of atmosphere, vertical temperature, temperature inversion, heat budget of the earth, atmospheric system, vertical stability atmosphere, Biochemical cycles of C, N, P, S and O. Biodistribution of elements.

Hydrosphere
Chemical composition of water bodies-lakes, streams, rivers and wet lands etc.
Hydrological cycle
Aquatic pollution – Inorganic,organic, pesticide, agriculture, industrial and sewage, detergents, oil spills and oil pollutants. Water quality parameters – dissolved oxygen, biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and microorganisms. Water quality standards.
Analytical methods of measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.),residual chloride and chlorine demand.
Purification and treatment of water.

UnitII

Soils
Composition, micro and macro nutrients, pollution – fertilizers, pesticides, plastics and metals. Waste treatment.

Atmosphere
Chemical composition of atmosphere – particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of N, C, S, O and their effect, pollution by chemicals, petroleum, minerals, chlorofluorohydrocarbons.
Green house effect, acid rain, air pollution controls and their chemistry.
Analytical methods for measuring air pollutants. Continuous monitoring instruments.

Unit III
Industrial Pollution
Cement, sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy. Polymers, drugs etc.
Environmental disasters – Cherbonyl, Three mile island, Seveso and minamata disasters, Japan tsunami.

Unit IV
Environmental Toxicology
Toxic heavy metals **:** Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation,

sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects.
Toxic Organic Compound **:** Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.

Unit-V

Aquatic Chemistry and Water Pollution. Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphure and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.

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

M.Sc(IV) Semester
Course MCH 403 B Departmental Elective
Chemistry of Materials

UNIT I

Ceramics, Composites and Nanomaterials. Ceramic structures, mechanical properties, clay products. Refractories, characterization, properties and applications. Microscopic composites, dispersion-strengthened and particle-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, properties and applications.

UNITII

Liquid Crystals. Thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases. Molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.

UNIT III

Ionic Conductors. Types of ionic conductors, mechanism of ionic conduction, interstitial jumps (Frenkel); vacancy mechanism, diffusion superionic conductors, phase transtions and mechanism of conduction in superionic conductors. Examples and applications of ionic conductors.

UNITIV

High Tc Materials. High Tc superconductivity. Preparation and characterization of 1-2-3 and 2-1-4 materials. Normal state properties, anisotropy, temperature dependence of electrical resistance, and optical phonon modes. Superconducting state; heat capacity; coherence length, elastic constants, microwave absorption-pairing and multigap structure in high Tc materials. Applications of high Tc materials.

UNIT V

Organic Solids, Fullerenes, Molecular Devices. Conducting organics, organic superconductors, magnetism in organic materials. Fullerenes, doped, fullerenes as superconductors. Molecular rectifiers and transistors, artificial photosynthetic devices, optical storage memory and switches, sensors.Non-linear optical materials, non-linear optical effects. Molecular hyperpolarisability

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

M.Sc(IV) Semester

Course MCH 404 Open Elective
Biochemistry

UNIT-I
Carbohydrates: Types of naturally occurring sugars: Deoxy-sugars, amino sugars, branched chainsugars. General methods of structure and ring size determination with particular reference tomaltose, lactose, sucrose, pectin, starch and cellulose, photosynthesis of carbohydrates, metabolism of glucose, Glycoside- (amygdalin).

UNIT-II
Amino acid, peptides and proteins: General methods of peptide synthesis, sequence determination. Chemistry of insulin and oxytocin. Purines and nucleic acid. Chemistry of uric acid, adenine,protein synthesis.

UNIT-III
Vitamins: A general study, detailed study of chemistry of thiamine (Vitamin B1), Ascorbic acid (Vitamin C), Pantothenic acid, biotin (Vitamin H), α-tocopherol (Vitamin E), Biological importance of vitamins.

UNIT-IV
Enzymes: Nomenclature and classification, extraction and purification, Remarkable properties of enzymes like catalytic power, specificity and regulation, Proximity effects and molecular adaptation, Chemical and biological catalysis. Mechanism of enzyme action: Transition state theory, orientation and steric effect, acid base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms (chymotrypsin, ribo nuclease, lysozyme and carboxypetidase A). Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors affinity labeling and enzyme modification by site directed mutagenesis. Enzyme kinetics, Michaelis-Menten and Lineweaver-Burk plots, reversible and irreversible inhibition.

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UNIT-V
(A) Kinds of reactions catalyzed by Enzymes: Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate addition and elimination reactions, enolic intermediates in isomerization reactions, β- cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation reactions.
(B) Coenzyme Chemistry: Cofactors as derived from vitamins, coenzymes, prosthetic groups,and apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate pyridoxal phosphate, NAD+, NADP+, FMN, FAD, Lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors.

St. Aloysius College, Jabalpur

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

M.Sc(IV) Semester

Course MCH 404 Open Elective
Bioorganic Chemistry

Unit-I
Introduction : Basic Consideration, Proximity effects and molecular adoption.
Enzymes: Introduction, Chemical and Biological catalysis, remarkable properties of enzymes, Nomenclature and classification, concept and identification of active site by use of inhibitors, reversible & irreversible inhibition.

Unit-II
Kinds of Reactions Catalyzed by Enzymes: B-cleavage and consideration, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.
Mechanism of Enzyme action: Transition state theory, Orientation and steric effect, acid-base catalysis, covalent catalysis.
Co-Enzyme Chemistry: Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes, Structure and biological functions of coenzyme A.

Unit-III
Enzyme Models : Host guest chemistry, Chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality, Biomimetic chemistry, crown ethers, cryptates, cyclodextrins, cyclodextrin based enzyme models, Calixarenes, ionophores, micelles synthetic enzyme or synzymes.

Unit-IV
Biotechnological Application of enzymes: Large scale production and purification of enzymes, techniques and methods of immobilization of enzyme activity, application of immobilized enzymes, effect of immobilization on Enzyme activity, application of immobilized enzymes. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA technology.

Unit-V
Metalloenzymes
Copper enzymes, superoxide dismutase, cytochrome oxidase and ceruloplasmin; Coenzymes; Molybdenum enzyme: xanthine oxidase; Zinc enzymes: carbonic anhydrase, carboxy peptidase and interchangeability of zinc and cobalt in enzymes; Vitamin B12 and B12 coenzymes; Iron storage, transport, biomineralization and siderophores, ferritin and transferrins..

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

M.Sc(IV) Semester

Syllabus M.Sc Biotechnology (Interdisciplinary with Chemistry)

Fundamentals of Applied Chemistry

Credits: 02

Unit I

Significant figures. Accuracy and precision. Errors, systematic and random errors. *Acid-Base Titrations. Complexometric Titrations.* Titration with EDTA. Indicators for EDTA titrations. Titration methods: direct and back titrations, and displacement methods. Masking and demasking agents, and their use in EDTA titrations.

Unit II

Bonding in organic molecules. Delocalized chemical bonding-conjugation, cross conjugation, Conjugation.Bonds weaker than covalent bond. Hydrogen bonding. VSEPR theory and its application

Unit III

X-ray Diffraction. Bragg condition, Miller indices, Laue method, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystals. Structure of simple lattices and X-ray intensities. *Introduction to Electron Diffraction and Neutron Diffraction.*

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

Inorganic Chemistry: Course MCH 106

Qualitative analysis:

1. To identify the given cation, anion and interfering radicals (total six including one interfering radical) from the given inorganic mixture.

Chromatography

1. Separation of cations and anions by Paper Chromatography

2. Separation of cations and anions by Column Chromatography; Ion exchange

Synthesis:

Preparation of selected inorganic compounds and their studies by measurements of decomposition temperature, molar conductance, I.R., electronic spectra, and magnetic susceptibility measurements.

3. $Hg[Co(SCN)_4]$

4. $[Ni(NH3)_6]Cl2$

5. $[Ni(dmg)_2]$

6. $[Cu(NH_3)_4]SO_4 \cdot H_2O$

7.Potassium tris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$

8.$[Ni(NH_3)_6]Cl_2$

.9.$[Fe_4[Fe(CN)_6]_3$

10. $[Ni\ (acac)_2(H_2O)]$

11. $[Co\ (acac)_2(H_2O)]$

14. Potassium tris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$ and determination of oxalate using permanganate.

Interpretation of IR and Electronic Spectra of some known compounds

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
CBCS PRACTICAL 2019-20
Physical Chemistry (Course MCH 107)

Adsorption

1. To study surface tension -concentration relationship for solutions (Gibbs equation).

Phase Equilibria

2. To construct the phase diagram for three component system (e.g., chloroform-acetic acid-water).*Polarimetry*
3. To calculate specific rotation of sucrose
4. Enzyme kinetics -inversion of sucrose

Chemical Kinetics

(1) Determine the rate constant of hydrolysis of an ester as methyl acetate catalysed by an acid . Determine also the energy of activation of the reaction

(2) Determination of the primary salt effect on the kinetics of ionic reactions and testing of the Bronsted relationship (iodide ion is oxidised by persulphate ion)

(3) Determination of the velocity constant of hydrolysis of an ester and to study the effect of change of concentration on it.

Isothermal Adsorption

(4) To study the adsorption of oxalic acid on charcoal and to prove the validity of Freundlich adsorption isotherm.

(5) To study the adsorption of oxalic acid on charcoal and to prove the validity of Langmuir's adsorption isotherm.

(6) To study the variation of thermo emf with the temperature for the copper-iron thermocouple.

(7) To study forward and reverse characteristics of Si and Ge semiconductor diode

(8) To observe the wave form of (i) a.c. mains supply and (ii) an oscillator using cathode ray oscilloscope

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
CBCS PRACTICAL 2019-20
Organic Chemistry (Course MCH 206)

Analysis

Separation, purification and identification of compounds of binary mixture (one solid and one liquid/solid) using chemical separation and sublimation/distillation, etc. Their analysis by semi-micro chemical tests and spot tests. IR spectra to be used for functional group identification. Preparation of one derivative of each compound. Emphasis should be placed on physical principles, reaction chemistry and the technique involved in analysis.

Organic Synthesis

Aromatic electrophilic substitutions:

1. Synthesis of m-dinitrobenzene from nitrobenzene
2. Synthesis of 2,4-dinitro-1-chlorobenzene from chlorobenzene
3. Synthesis of 4-bromoaniline from acetanilide

Reduction reaction:

Synthesis of m-nitroaniline from m-dinitrobenzene

Oxidation reaction

1. Synthesis of 9,10-anthraquinone by oxidation of anthracene by chromium trioxide
2. Synthesis of 4-nitrobenzaldehyde by oxidation of 4-nitrotoluene by chromium trioxide

Cannizzaro reaction

1. Synthesis of benzyl alcohol from benzaldehyde

Claisen-Schmidt reaction:

2. Synthesis of dibenzylideneacetone (1,5-diphenylpenta-1,4-dien-3-one) from acetone and benzaldehyde

Sandmeyer reaction:

3. Synthesis of 2-chlorobenzoic acid from anthranilic acid

Methylation:

4. Synthesis of methyl 2-naphthyl ether (2-methoxynaphthalene, nerolin) by methylation of 2-naphthol by dimethyl sulphate.

Purification of compounds by TLC and column chromatography.

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
CBCS PRACTICAL 2019-20
Inorganic Chemistry (Course MCH: 207):

Gravimetric Estimation (any two experiments):

Estimte mixture of 2 metal ions(Copper and Zinc)

Sectrophotometric Determination

1. Determination of molecular composition of ferric salicilate /iron-phenanthroline/iron-dipyridyl complex by Job's method of continuous variation
2. Determination of the pH of a given solution by spectrophotometry using methyl red indicator

Synthesis.

1. Aquabis(acetylacetonato)nitrosylchromium(I), $[Cr(NO)(acac)_2(H_2O)]$
2. cis-Bis(glycinato)copper(II) and trans-Bis(glycinato)copper(II)
3. Preparation of Zn, Cd and Hg thiocyanates from their respective chlorides
4. Bis(benzoylacetonato)copper(II)
5. Bis (acetylacetonato)oxovanadium(IV), $[VO(acac)_2]$
6. $[MoO_2(acac)_2]$
7. Hexaammminenickel(II)tetrafluoroborate, $[Ni(NH_3)_6](BF_4)_2$ and determination of nickel content gravimetrically.
8. Potassium tris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$ and determination of oxalate using permanganate.
9. Preparation of N,N-bis(salicylaldehyde)ethylenediamine $[salenH_2]$, Co(salen)

Interpretation of ESR, NMR and Thermogravimetric pre-recorded results of known compounds

Pre-recorded spectrum/data shall be provided for their interpretation leading to structure determination of metal ion complexes with organic ligands

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
CBCS PRACTICAL 2019-20
Organic Chemistry II (Course MCH 305):

Analysis

1. Estimation of protein by Lowry's method.
2. Estimation of carbohydrate by Anthrone's method
3. Isolation of caffeine and alkaloids from tea.
4. To determine the iodine value of the given oil or fat
5. To determine the Saponification value of the given oil or fat
6. Estimation of Ascorbic Acid i.e. vitamin C.
7. Estimation of Amino acid by Sorenson's method
8. Spectrophotometric estimation of Glucose with the help of Fehling solution

Multi Step Synthesis

1. Benzoin- benzyl- benzilic acid
2. Benzophenone –benzpinacole- benzpinacolone
3. Ethyl acetoacetate → 3-methyl-1-phenylpyrazol-5-one → antipyrin (phenazone)
4. Benzaldehyde → benzoin → benzil → 5,5-diphenylhydantoin
5. Phenylhydrazine → acetophenone phenylhydrazone → 2-phenylindole
6. Chlorobenzene → 1-chloro-2,4-dinitrobenzene → 2,4-dinitrophenylhydrazine

Spectral Analysis

Interpretation of pre-recorded UV-Vis, IR, NMR, Mass, Raman spectrum and characterisation of one organic compound.

St. Aloysius College, Jabalpur
Department of Chemistry
According to the Department of Higher Education, Govt. of M.P.
CBCS PRACTICAL 2019-20
Physical Chemistry (Course MCH 306):

Conductometry

1. To determine the strength of unknown (given weak) acid conductometrically using standard alkali solution(strong).
2. To determine the strength of unknown (given strong) acid conductometrically using standard alkali solution(weak).
3. To determine the dissociation constant of weak electrolyte and to verify Ostwald's dilution law.
4. To determine the equivalent conductance of strong electrolyte at the several concentration and hence verify Onsagar equation.

Potentiometry

5. To determine the strength of unknown (given weak) acid potentiometrically using standard alkali solution (strong).
6. To determine the strength of unknown (given strong) acid potentiometrically using standard alkali solution (weak).

Spectrophotometery

7. To verify Lambert-Beer's law using a spectrophotometer.
8. To determine the basicity of an acid.
9. To study the effect of temperature on invertase enzyme activity and determine its optimum pH
10. To study of the effect of substrate concentration on enzyme activity.
11. Effect of enzyme concentration on enzyme activity.
12. To find the solubility and solubility product of sparingly soluble salt conductometrically.