St. Aloysius College, Jabalpur
Department of Chemistry and Biochemistry
According to Department of Higher Education, Govt. of M.P.
Under Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
Chemistry Syllabus Session 2017-18

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

UNIT I

A. Atomic Structure Dual nature of matter**,** Idea of de Broglie's matter waves, Heisenberg uncertainty principle, atomic orbitals, 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 orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule, electronic configuration of the elements, effective nuclear charge.

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 : 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, SF_4, ClF_3, H_3O. and H_2O. MO theory -Homonuclear and heteronuclear (CO and NO) diatomic molecules, multi-center bonding in electron deficient molecules, bond strength and the bond energy.

UNIT III

Chemical Bonding Part II: Ionic Solids -structures , radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond-free electron, Valence bond and Band theories.

Weak interaction – Hydrogen bonding, vanderwaals forces

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.

B. p-Block Elements 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 II Hydrides of boron-diborane and higher boranes. Borazine, borohydrides. Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetra sulphur, tetranitride, basic properties of halogens, interhalogens and polyhalides.

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

UNIT I

A. Mathematical Concepts : Logarithmic relations (rules and types), use of log table and anti log table in calculations. curves stretching, straight line and linear graphs and calculation of slopes, Differentiation of functions like Kx, ex, xn, sinx, logx; multiplication and division in differentiation, maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; Factorials, Probability.

B. Gaseous States and Molecular velocities Critical phenomenon : PV isotherms of ideal gases, Andrews 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 effect and coordination number, limitation of radius rule, lattice defects**.**

UNIT III

Chemical kinetics: Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reactionconcentration, temperature, pressure, solvent, light and catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions- zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction – differential method, method of integration, method of half life period. Experimental methods of chemical kinetics - polarimetry and spectrophotometery. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis)

UNIT IV

Radioactivity and nuclear chemistry: Natural and artificial radioactivity, radioactive radiations, theory of radioactivity, Group displacement law of soddy ,radioactive disintegration, nuclear reactions, nuclear fission and fusion, half life period, isotopes, isobars and isomers, application of radiochemistry.

UNIT V

A. Chemical equilibrium: Law of mass action, Equlibrium constant, Le-chteliers principles**.**

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 colloidals.

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

UNIT I

A .Structure and Bonding : Hybridizations, Bond lengths and bond angles, bond energy : Localized and delocalized chemical bond, van-der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, , inductive and electromeric effects, mesomeric and steric effect.

B. **Mechanism of organic reactions**: Homolytic and heterolytic bond fission, Types of reagents-Electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates- (carbocations, carbanions, free radicals and carbenes, arenes and nitrene with examples) Methods of determination of reaction mechanism(Active intermediate products) isotope effect, kinectic and stereochemical studies..

UNIT II

Alkanes and Cycloalkanes: IUPAC nomenclature of branched and unbranched alkanes, classification, isomerism in alkanes, sources and methods of preparation (with special reference to Wurtz, Kolbe, Corey-House reactions 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 preparations, chemical reactions. Baeyer's strain theory and its limitations. ring strain in cyclopropane and cyclobutanes. Theory of strainless rings. The case of cyclopropane ring: Banana bond, conformation of cycloalkane.

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UNIT III

Alkenes, cycloalkenes and Dienes: Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity 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 additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, Epoxidation, ozonolysis,

hydration, hydroxylation and oxidation with KMnO4,polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications 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, polymerization. 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 of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation, metal ammonia reduction, oxidation and polymerization

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions; mechanims of nucleophilic substitution reaction of alkyl halides, SN^2 and SN^1 reactions with energy profile diagrams. Elimination reaction Polyhalogen compounds: Method and preparation properties of chloroform, carbon tetrachloride

UNIT V

S**tereochemistry of organic compound** Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogenic centres, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configurations, sequence rule, D &L , R & S systems of nomenclature. Geometrical isomerism- determination of configuration of geometric isomerism. E and Z system of Nomenclature geometrical isomerism in alicyclic compounds. Geometric isomerism in oximes and alicyclic compound

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Chemistry Syllabus Session 2017-18

Class B.Sc. (III) Semester **Maximum Marks: 85**

UNIT I

A. Arenes and Aromaticity: Structure of benzene, molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure.

MO picture. Aromaticity, the Huckel rule. Aromatic electrophilic substitution, General pattern of the mechanism-Mechanism of nitration, halogenation, sulphonation,

mercuration and Friedel-Crafts reaction and energy profile diagram

B. Aryl Halides: Methods of formation and reactions of aryl halides, Mechanism of nucleophilic aromatic substitution, synthesis and uses of DDT, BHC and Freon.

UNIT II

A. **Alcohols:** Classification and nomenclature.

1. **Monohydric alcohols:** nomenclature, methods of formationby reduction of aldehydes, ketones, carboxylic acid, and esters, acidic nature, reactions of alcohols.

2. **Dihydric Alcohols:** Nomenclature, methods of formation, chemical reactions of

vicinal glycols, oxidative cleavage [Pb(OAc)4, and HIO4] and pinacol-pinacolone rearrangement.

3.Trihydric alcohols - nomenclature and methods of formation, chemical reaction of glycerol.

B**. Phenols**: Nomenclature, structure and methods of formation, acidic character. Comparative acidic strength of alcohols and phenols, stabilization of phenoxide ion by resonance, acylation and carboxylation Mechanisms of Fries rearrangements, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Riemer-Tiemann reaction.

UNIT III

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

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

UNIT IV

A. Coordination Compounds: IUPAC Nomenclature, Isomerism EAN Concept, Chelates, VBT of transition metal complexes, its limitations. Crystal field theory,

Crystal Field Stabilization Energy, spectrochemical series, limitations of CFT.

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.

Second Law of Thermodynamics: Need for the law, Different statements of the law, Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature.

UNIT V

A. Thermodynamics: Concept 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.

B. Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function (A) as a thermodynamic quantities, A and G as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, relative variation of G & A with P, V & T.

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

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Chemistry Syllabus Session 2017-18

Class B.Sc. (IV) Semester **Maximum Marks: 85**

UNIT I

A. 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.

B. 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.

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

D. 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 II

Electrochemistry

A. Electrical transport: conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, variation of specific conductance and equivalent conductance with dilution, 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.

B. Types of reversible electrodes: Gas metal ion, metal-meal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode, standard electrode potential.EMF of a cell and its measurements, computation of cell EMF, calculation of thermodynamic quantities of cell reaction (DG, DH,K). Solubility product and activity coefficient, potentiometric and conductometric titration. Definition of pH and pK, determination of pH using hydrogen,quinhydrone and glass electrodes by potentiometric methods.

UNIT III

A. 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 fromacid chlorides, synthesis of aldehydes and ketones using. 1,3 dithianes, synthesis of ketones from nitriles and from carboxylicacids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol Perkin and Knovenagel condensations. Condensation with ammonia andits 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, LiAIH4 and NaBH4 reduction.

B. Carboxylic acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents onacid strength. Preparation of carboxylic, reaction of carboxylicacids. Hell Volhard Zelinsky reaction. Synthesis of acid chlorides

ester and amides reduction of carboxylic acids, mechanism of decarboxylation.

UNIT IV

A. Carboxylic acids derivatives: structure and nomenclature of acid chlorides, esters amides and acid anhydrides. Physical properties, interconversion of acid derivative by nucleophilic acylsubstitution, preparation of carboxylic acid derivatives, chemical

reactions. Mechanism of esterification and hydrolysis (acidic andbasic).

B. Coordination Chemistry: MOT (molecular orbital theory) diagram for tetrahedral, square planar and octahedral complexes.

C. Green Chemistry: Principles, 12 tenets, their description with examples.

UNIT V

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

B. 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.

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Chemistry Syllabus Session 2017-18

Class B.Sc. (V) Semester **Maximun Marks: 85**

UNIT I

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, picric acids. 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

UNIT II

Carbohydrates-I

Classification and nomenclature, monosaccharide, mechanism of osazone formation, chain lengthening and chain shortening of aldoses, epimerization, configuration of monosaccharide, erythro, threo diasterioisomers. Formation of glycosides, ethers and esters, determination of ring size of monosaccharide, cyclic structure of D(+) glucose, mechanism of mutarotation. Structure of ribose and deoxyribose.

Carbohydrates-II

An introduction to glycosidic linkages in di and polysaccharides. Reducing and non-reducing sugars

UNIT III

(a) Photochemistry: Electromagnetic radiation, range of different regions of the spectrum, different expression units for energy, wavelength and frequency Interaction of radiation with matter, difference between thermal and photochemical process.

Laws of photochemistry – Grotthus-Draper law, Stark-Einstein law, Beer-Lambert law. Electronic transitions, Jablonski diagram depicting various quantum yield.

(b) UV Spectroscopy: Electronic excitation, elementary idea of instrument used, Application to organic molecules. Woodward-Fieser rule for determining _max of enes, polyenes and α,β - unsaturated carbonyl compounds

UNIT IV

Bioinorganic Chemistry - I

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

Bioinorganic Chemistry - II

Role of metal ions in biological process, nitrogen fixation, oxygen-uptake proteins, cytochromes and ferredoxins.

UNIT V

Hard and Soft Acids and Bases (HSAB)

Classification of acids and bases as hard and soft, Pearson's HSAB concept, symbiosis.

Analytical Chemistry: Errors, their classification, minimization of errors, precision and accuracy, gravimetric estimation - concept, method and precautions, gravimetric
estimation of barium and copper.

Inorganic Polymers: Introduction and scope of inorganic polymers, special characteristics, classification and their applications. Structure and nature of bonding in Silicones and triphosphonitrilic chloride

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Class B.Sc. (VI) Semester **Maximum Marks: 85**

UNIT I

A. Amino acids: Classification, structure, stereochemistry of amino acids, acid base behaviour, isoelectric point, general methods of preparation and properties of _-amino acids. Proteins and peptides. Introduction to peptides linkage, end group analysis, classification, properties and structure of proteins (primary, secondary and tertiary).

B. Nucleic acids: Introduction of nucleic acids and constituents of nucleic acid, Ribonucleosides,Ribonucleotides, double helical structure of DNA.

C. Elementary idea of Fats, Oils & Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils,
Saponification value, iodine value, acid value

UNIT II

A. Organometallic Chemistry: Synthesis; structure and bonding in metal carbonyl complexes, metal olefin complexes and metal alkyne complexes. Oxidative addition reactions.

B. Organometallic Compounds: Organomagnesium Compound - Grignard Reagent and Organolithium Compounds, methods of preparation, structure and synthetic applications

UNIT III

A. Magnetic properties of transition metal complexes:magnetic moment (spin only and with L-S coupling),orbital contribution magnetic moment.

B. Electronic spectra of transition metal complexes: Spectroscopic ground and excited states, types of electronic transitions, selection rules for d-d transitions, Orgel-energylevel diagram for d^1 to d^9 states.

C. Water Analysis: Hardness, types of hardness, acidity and alkalinity, BOD, COD and DO.

UNIT IV

A. Infrared spectroscopy : Statement of the Born-Oppenheimer approximation, rotational spectrum of diatomic molecules. Energy levels of a rigid rotator, selection rule, intensity of absorption bands, Maxwell-Boltzmann distribution and population of energy levels.

B. Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity and qualitative relation of force constant and bond energies, degree of freedom andmodes of vibration, vibrational frequencies of differentfunctional groups.

C. Raman Spectroscopy: concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomicmolecules. Selection rules, application of Raman spectrum.

UNIT V

A. NMR Spectroscopy Principle and Instrumentation, NMR active nucleus, chemical shift, spin-spin coupling, spectrum of ethanol and ethanal.

B. Surface Phenomena and Catalysis: adsorption of gases and liquids on solid adsorbent, Freundlich and Langmuir adsorption isotherms, determination of surface area, characteristics and mechanism of heterogeneous catalysis.

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Class B.Sc. (I) Year **Maximum Marks.**
50

Paper : Practical

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

Inorganic mixture analysis **8 Marks**

1. Mixture Analysis for 2 Cations and 2 Anions

2. Separation of cations by paper chromatography. **4 Marks**

Viva: **6 marks**

Records: **4 marks**

Sessionals: **4 marks**

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Class B.Sc. (III) Semester **Maximum Marks. 50**

Title of Subject Group / **Chemistry Practical**

Time: 6 hour

Inorganic Chemistry 18 marks

1. Calibration of the fractional weights, pipettes and burettes.
2. Preparation of standard solutions. Dilution of 0.1 M to 0.01 M Solutions.

Quantitative analysis - Volumetric analysis.

1. Determination of acetic acid in commercial vinegar using NaOH.
2. Determination of alkali content- antacid tablet using HCl.
3. Estimation of calcium content in chalk as calcium oxalate by permagnatometry.
4. Estimation of hardness of water by EDTA.

Complex Compound Preparation:

1. Diaquabis(methyl acetoacetato) nickel(II)
2. Potassium chlorochromate (IV)
3. Tetraamminecopper(II) sulphate monohydrate
4. Hexaamminenickel(II) chloride

Organic Chemistry Laboratory Techniques 18 marks

A. Thin layer chromatography Determination of Rf values and identification of organic compounds.

1. Separation of green leaf pigments (spinach leaves may be used)
2. Preparation and separation of 2, 4- dinitrophenylhydrazones of acetone, 2-butanone, hexane-2 and 3-one using toluene and light petroleum (40:6).
3. Separation of a mixture of dyes using cyclohexane and ethylacetate.(8:5:1.5).

B. Paper chromatography: Ascending and Circular Determination of Rf values and identification of organic compounds.

1. Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid. Spray reagent ninhydrin.
2. Separation of mixture of DL-alanine, glycine and L-lucine using n-butanol: acetic acid : water (4:1:5). Spray reagent ninydrin.
3. Separation of monosaccharides- a mixture of D-galactose and D-fructose using n-butanol : acetone : water (4:1:5). Spray reagent-aniline hyddrogen pthalate.

Viva 06 Marks

Sessional 08 Marks

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Chemistry Syllabus Session 2017-18

Class B.Sc. (IV) Semester **Maximum Marks. 50**

Title of Subject Group / **Chemistry Practical**

Time: 6 hour

Organic Chemistry 12 Marks

Qualitative analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

Physical Chemistry 12 Marks

A.Transition temperature

1. Determination of transition temperature of given substance by theromometric, dialometric method (e.g.) (MnCl2, 4H2O/SrBr2, 2H2O)

B.Phase equilbrium

1. To study the effect of solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquid (e.g.,phenol water system).

2. To construct the phase diagram of two component (e.g., diphenylamine benzopheone) by cooling curve method.

C.Thermochemistry

1. To determine the enthalpy of neutralization of weak acid/weak base versus strong acid/strong base and determine the enthalpy of ionization of the weak acid/base.

Inorganic chemistry-Quantitative Volumetric Analysis 12 Marks

1. Estimation of ferrous and ferric by dichromate method.

2. Estimation of copper using thiosulphate.

Viva 06 Marks

Sessional 08 Marks

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Chemistry Syllabus Session 2017-18

Class B.Sc. (V) Semester **Maximum Marks. 50**

Title of Subject Group / **Chemistry Practical**

Time: 6 hour

Inorganic Chemistry 12 Marks

Analysis of inorganic mixture containing five radicals with at least one interfering radical or typical combination

Gravimetric analysis : 12 Marks

Barium as barium sulphate.

Organic Chemistry 12 Marks

Preparation:

(i). Acetylation

(ii). Benzoylation

(iii). meta-Dinitrobenezene

(iv). Picric acid

Viva 06 Marks

Sessional 08 Marks

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Chemistry Syllabus Session 2017-18

Class B.Sc. (VI) Semester **Maximum.**

Marks: 50

Class /: B.Sc.

Semester / VI

Title of Subject Group: **Chemistry Practical**

Compulsory /: Compulsory

Time: 6 hour M.M: 50

Inorganic Chemistry 12 Marks

(i) Effluent Analysis

Identification of cations and anions in different water samples.

(ii) Water analysis

a. To determine the amount of dissolved oxygen in water samples in ppm units.

b. To determine the amount of COD in water samples in ppm units.

(iii)Determination of Hardness of Water

Organic Chemistry 12 Marks

Binary mixture analysis containing two solids: Separation, identification and preparation of derivatives.

Physical Instrumentation 12 Marks

(iii) Job's method

(iv) Mole-ratio method**.**

Viva 06 Marks

Sessional 08 Marks

BIOCHEMISTRY SYLLABUS 2017-2018

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Biochemistry Syllabus Session 2016-17

Class B.Sc. (I) Semester **Maximum Marks: 85**

Paper-Biomolecules

UNIT I

Introduction to Biochemistry, Water as a biological solvent. ***Hydrogen Bonding***. Carbohydrates: Structure, occurrence and biological importance of monosaccharides and disaccharides; Stereoisomerism and optical isomerism of sugars; Ring structure, epimers, anomers and mutarotation Important reactions of sugars. Important derivatives of monosaccharides; Structure occurrence and biological importance of oligosaccharides and polysaccharides. e.g.Cellulose, glycogen and starch, chitin, agar.Mucopolysachharides;

UNIT II

Fatty acids: Classification, structure and properties of saturated and unsaturated fatty acids; Essential fatty acids; Triacylglycerols, properties and characterization of fats – hydrolysis, Saponification, halogenation, Acetyl number, Rancidity of fats, Reichert-Meissel number; Reaction of glycerol; Glycerophospholipids Structure & function of (lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol plasmalogens); Sphingomyelins Structure & function of glycolipids- cerebrosides, gangliosides. Cholesterol, Bile Acids

UNIT III

Amino acids: Structure and classification of amino acids, stereoisomerism, zwitter ion in aqueous solutions; physical and chemical properties, titration of amino acids, Isoelectric pH; Essential amino acids; Peptides: Peptide bond, Determination of the amino acid sequence of a polypeptide chain, chemical and enzymatic cleavage of a polypeptide chains and separation of peptides; ***Salting in and salting out of proteins***, Denaturation and renaturation of proteins.

UNIT IV

Protein structure: Levels of structure in protein architecture, primary structure of proteins, secondary structure of proteins – helix and pleated sheets, tertiary structure of proteins, forces and bonds stabilizing the structure proteins; ***Ramachandran Plots***, Structure of fibrous proteins (keratins and collagen), globular proteins (hemoglobin and myoglobin); Composition of DNA and RNA. Features of DNA double helix. Denaturation and annealing of DNA; Secondary and tertiary structure of DNA, Watson Crick model, A, B and Z type of DNA; Different types of RNA and their role, Secondary, and tertiary structure of RNA.

UNIT V

Important Metalloporphyrins occurring in nature; Bile pigments- chemical nature and their physiological significance; Hormones: biological functions of Insulin, Glucagon, Epinephrine, Thyroxine; Properties and role of fat-soluble and water-soluble vitamins; Coenzyme functions of vitamins.

St. Aloysius College, Jabalpur

Department of Chemistry and Biochemistry

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

Under Graduate Semester wise Syllabus

as recommended by Central Board of Studies and approved by the Governor of M.P.

Biochemistry Syllabus Session 2016-17

Class B.Sc. (II) Semester **Maximum Marks: 85**

Paper-Biophysical & Biochemical Techniques

UNIT I

Weak acids and bases, pH, buffers, Henderson-Hasselbalch equation, physiological buffers; Principle of glass & reference electrode; Dependence of pH on ionic strength, ***pH meter*** electrode contamination and sodium error); Sedimentation- sedimentation velocity, preparative and analytical centrifugation techniques, ultracentrifugation; Determination of molecular weight by hydrodynamic methods.(derivation Excluded).

UNIT II

General principle of chromatographic separation- Paper and thin layer chromatography; Technique and applications of Column chromatography, partition chromatography, Molecular-sieve chromatography, Ion-exchange chromatography, Affinity Chromatography.

UNIT III

Technique and applications of: Gas chromatography, ***Gas Liquid Chromatography***HPLC; Basic principle of electrophoresis; Agarose electrophoresis; PAGE : native and SDS; Isoelectricfocussing.

UNIT IV

Beer-Lambert law; ***Light absorption and transmission,*** determination and application of extinction coefficient; Principal & Applications of UV- Visible spectroscopic techniques (structure elucidation &Numerical excluded); Fluorescent & emission spectroscopy.

UNIT V

Characteristics of radioisotopes, units of radioactivity measurements; Techniques used to measure radioactivity (gas ionization and scintillation counting), Autoradiography; Isotopes commonly used in biochemical studies – 32P, 35S, 14C and 3H; Biological hazards of radiation and safety measures in handling radioisotopes; Biological applications of Radioisotopes.

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (III) Semester **Maximum Marks: 85**
Paper-Cell Biology & Physiology

UNIT I

Morphology of cell, Prokaryotic and eukaryotic cell structure, Differences in plant and animal cell, Structure and composition of plant and bacterial cell wall Structure, ***Gram Staining*** and composition of plasmamembrane, Transport of metabolites across plasma membrane, Passive and active transport

UNIT II

Structure and function of nucleus, mitochondria and chloroplast., Structure and functions of Ribosomes, endoplasmic reticulum, Golgi apparatus and peroxisomes, lysosomes, cytoskeleton

UNIT III

Blood components and their functions, Blood groups: the ABO system, the rhesus system, Blood clotting factors, intrinsic and extrinsic pathways for blood clotting. Various buffer systems of the blood: Acid-base balance, factors affecting acid-base balance, acidosis, and alkalosis, role of lung and kidney in regulation of acid-base balance.

UNIT IV

Components of respiratory system (nasal cavity, trachea, pharynx, larynx, lungs, bronchi, bronchioles and alveoli) and their functions. Diffusion of oxygen and CO2, transport of oxygen, role of hemoglobin, dissociation curve of oxyhemoglobin and its significance, Bohr's effect, transport of CO2 and chloride shift, ***Effect of industrial toxins on respiratory system.***

UNIT V

Kidney: Structure and its organization. Functions of glomerular membrane and glomerular filtration rate (GFR). Structural and functional characteristics of tubules, selective reabsorption and secretion, active and passive transport of various substances (sugars, amino acids, urea and creatinine), mechanism of urine formation

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Biochemistry Syllabus Session 2016-17

Class B.Sc. (IV) Semester **Maximum. Marks: 85**

Paper-Enzymology & Molecular Biology

UNIT I

Nomenclature, IUB enzyme classification (rationale, overview and specific examples).Definitions with examples of holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, active site, metallo-enzymes. Isoenzymes**,** Enzyme specificity, Enzyme active site structure Factors affecting enzyme activity: enzyme concentration, substrate concentration, pH and temperature. Derivation ofMichaelis - Mentenequation for uni-substrate reactions. Km and its significance.Line Weaver-Burk plot and its limitations.

UNIT II

Reversible and irreversible inhibition, Types of inhibition: competitive, non-competitive, uncompetitive and mixed. Enzyme Regulation: Various modes of regulation, Allosteric enzymes, covalently modulated enzyme. Mechanism of enzyme action: Acid-base catalysis, covalent catalysis, proximity and orientation effects, strain and distortion theory. Role of metal ion Mechanism of action of chymotrypsin, carboxypeptidase, lysozyme, ribonuclease

UNIT III

DNA replication in prokaryotes – conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication. DNA polymerases, other enzymes and protein factors involved in replication.Mechanism of replication.Inhibitors of replication.

Transcription in prokaryotes, RNA polymerase, promoters, initiation, elongation and termination of RNA synthesis, inhibitors of transcription. Reverse transcriptase, post transcriptional processing of RNA in eukaryotes. Genetic code – Basic features, biological significance of degeneracy, ***Wobble hypothesis,*** gene within genes and ***overlapping genes.***

UNIT IV

Mechanism of translation – Ribosome structure, A and P sites, charged RNA, f-met – tRNA, initiator codon, Shine-Dalgarno consensus sequence, formation of 70S initiation complex, role of EF-Tu, EF-Ts, EF-G and GTP, non-sense codons and release factors, RF1 and RF2. Regulation of gene expression in prokaryotes – Enzyme induction and repression, Operon concept, Lac operon, Trp operon.

UNIT V

Mutation – Molecular basis of mutation, types of mutation, e.g. transition,transversion, frame shift, insertion, deletion, suppressor sensitive, germinal and somatic, backward and forward, true reversion and suppression, dominant and recessive mutations, spontaneous and induced mutations. DNA repair – UV repair systems in E. coli, ***Ames Test***significance of thymine in DNA. Recombinant DNA technology – Restriction endonucleases, brief description of steps in DNA cloning. Applications of recombinant DNA technology

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (V) Semester **Maximum Marks: 85**

Paper-Metabolism

UNIT I

Law of thermodynamics, concept of free energy, standard free energy, biological oxidation reduction reaction, high energyphosphate compounds. Electron transport chain, sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain. Hypothesis of mitochondrial oxidative phosphorylation, Inhibitors and uncouplers of oxidative phosphorylation.

UNIT II

Carbohydrate metabolism

Reactions and energetics of glycolysis, entry of fructose, galactose, mannose in glycolytic pathway. Reactions and energetics of TCA cycle.Regulation of glycolysis and TCA cycle.Gluconeogenesis, glycogenesis and glycogenolysis. Reactions and physiological significance of pentose phosphate pathway, Glycogen storage diseases ***Glucose Tolerance Test (GTT curves)***

UNIT III

Amino Acid Metabolism

General reaction of amino acid metabolism, transamination, oxidative deamination and decarboxylation. Urea cycle.Glycogenic and ketogenic amino acids.Inborn errors of amino acid metabolism, phenyl ketonuria, alkaptonuria and albinism.

UNIT IV

Lipid metabolism

Hydrolysis of triacylglycerols, transport of fatty acids into mitochondria. Beta-oxidation of fatty acids, ATP yields from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids.Formation of ketone bodies.Biosynthesis of cholesterol & regulation of cholesterol metabolism.

UNIT V

Nucleic acid metabolism

Sources of atoms in pyrimidine molecules.Biosynthesis and degradation of pyrimidines in brief. Regulation of pyrimidine biosynthesis.Sources of atoms in purine molecules. Biosynthesis and degradation of purines in brief. Regulation of purine biosynthesis, ***Clinical disorders of Purine and Pyrimidine metabolism.***

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (VI) Semester **Maximum Marks: 85**

Paper-Applied Biochemistry

UNIT I

Isolation of bacteria and pure culture techniques, Culture media, Nutritional types of bacteria, Bacterial Growth. ***Growth curve*** Bacterial fermentation, Aerobic and Anaerobic Respiration, Bacterial Photosynthesis Food spoilage and Preservation, Food Borne infection, Disposal of domestic and industrial sewage Structure and classification of viruses, Replication of RNA and DNA viruses, Virus host interaction, Types and life cycle of Bacteriophages.

UNIT II

Types of Immunity, Innate, Acquired, Passive and Active Immunity, Humoral and cellular Immunity, Structure and functions of immunoglobulins. Antigen-antibody reaction, Agglutination and precipitation, Immuno diffusion, Immuno electrophoresis, Immuno fluorescence, RIA and ELISA.

UNIT III

Collection and preservation of biological fluids such as blood, serum, plasma and urine and CSF. Hypo andhyperglyceamia, Hyperlipideamia, lipid malabsortion, steatorrhoea, role of lipoproteins in health and disease. Inborn errors of amino acids metabolism alkaptanurea, phenylketonurea, albinism, gout, hyperuricemia.

UNIT IV

Functional and non functional plasma enzymes, isoenzymes, enzyme pattern in health and disease for the enzymes alkaline and acid phosphatase, SGOT and SGPT, LDH and CPK. Function tests for kidney, liver and stomach.

UNIT V

Measurement of energy expenditure by direct and indirect calorimetry.Basal metabolic rate.Specific dynamic action of foods, Energy requirements of various groups.Nutritional aspects of carbohydrates, fats and proteins, essential fatty acids and amino acids, Protein calorie malnutrition (Kwashiorkar and marasmus). Outline of nutritional aspects of some vitamins (A, B1, B2, B12, C, D, and E) and minerals (calcium, phosphorus, iron and iodine).

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (I) Semester **Maximum**

Marks: 50

Title of Subject Group: **Biochemistry Practical**

Compulsory /: Compulsory

1. Qualitative Test for
    a. Carbohydrate
    b. Lipid
    c. Amino Acids
    d. protein
2. Estimation of glucose by Anthrone method or
3. Estimation of amino acid by Ninhydrin method
4. ***Titration curve of amino acids and determination of pK value.***
5. Detection of food Adulterants
6. Extraction of total lipids by Folch method

SCHEME OF PRACTICAL EXAM

TIME 03:00 Hr **MAX MARKS 50**

- Practical 25
- Viva – Voce 10
- Assignment / field work 05
- Sessionals (Record + Attendance) 10

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as recommended by Central Board of Studies and approved by the Governor of M.P.
Biochemistry Syllabus Session 2017-18

Class B.Sc. (II) Semester **Maximum Marks: 50**

Class /: B.Sc.

Semester / II

Title of Subject Group: **Biochemistry Practical**

Compulsory /: Compulsory

LIST OF PRACTICALS

1. Preparation of standard buffer & determination of pH of solution
2. Determination of Saponification value of fat
3. Estimation of ascorbic acid
4. Separation of sugars using paper chromatography
5. Verification of Beer Lamberts Law
6. Immunodiffusion (by blood grouping in agar gel)
7. Salting in & salting out of protein
8. ***Comparative Estimation of Ascorbic acid from natural and synthetic fruit juices.***
9. ***Separation of Anthocynin pigment using paper chromatography.***
10. ***Separation of amino acids by thin layer chromatography.***

SCHEME OF PRACTICAL EXAM

TIME 03:00 Hr **MAX MARKS 50**

- Practical 25
- Viva – Voce 10
- Assignment / field work 05
- Sessionals (Record + Attendance) 10

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (III) Semester **Maximum Marks: 50**

Title of Subject Group: **Biochemistry Practical**

Compulsory /: Compulsory

LIST OF PRACTICALS

1. Detection of normal and abnormal constituents of urine
2. Separation of Blood, plasma and serum,
3. Estimation of proteins from serum by Biuret method.
4. Determination of albumin and A/G ratio
5. Estimation of total lipids
6. Hemoglobin Estimation
7. Blood group determination
8. ***Bleeding Time***
9. ***Clotting Time***

SCHEME OF PRACTICAL EXAM

TIME 03:00 Hr **MAX MARKS 50**

- Practical 25
- Viva – Voce 10
- Assignment / field work 05
- Sessionals (Record + Attendance) 10

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (IV) Semester **Maximum**

Marks: 50

Title of Subject Group: **Biochemistry Practical**

Compulsory /: Compulsory

LIST OF PRACTICALS

1. Preparation of starch from potato and its hydrolysis by salivary amylase
2. Effect of substrate concentration on enzyme activity and determination of its Km value
3. Effect of temperature on enzyme activity
4. Effect of pH on enzyme activity
5. Effect of NaCl on enzyme activity
6. Estimation of DNA by diphenylamine method
7. Estimation of RNA by Orcinol method
8. ***Estimation of proteins from serum by Lowry's method.***

SCHEME OF PRACTICAL EXAM

TIME 03:00 Hr **MAX MARKS 50**

- Practical 25
- Viva – Voce 10
- Assignment / field work 05
- Sessionals (Record + Attendance) 10

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (V) Semester **Maximum Marks: 50**

Title of Subject Group: **Biochemistry Practical**

Compulsory /: Compulsory

LIST OF PRACTICAL

1. Estimation of Calcium in serum and urine.
2. Estimation of Phosphorus in serum and urine.
3. Estimation of Creatinine in serum.
4. Estimation of proteins by Biuret method.
5. Estimation of cholesterol in serum.
6. Estimation of triglycerides in serum.
7. Estimation of bilirubin in serum.
8. Estimation of SGOT in serum.
9. Estimation of SGPT in serum.
10. ***Estimation of Blood Urea Nitrogen***

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Biochemistry Syllabus Session 2017-18

Class B.Sc. (VI) Semester **Maximum Marks: 50**

Title of Subject Group: **Biochemistry Practical**

Compulsory /: Compulsory

LIST OF PRACTICAL

1. Estimation of Hemoglobin by measuring total iron in blood.
2. Estimation of Immunoglobulin by precipitation with saturated ammonium sulphate solution.
3. Estimation of amylase in serum.
4. Estimation of acid and alkaline phosphates in serum.
5. Determination of proteins by Dye Binding Assay.
6. Immunodiffusion (in agar gel).
7. Separation of proteins by Gel Electrophoresis.
8. **Determination of Quality of given milk by Methylene Blue Reductase test.**
9. **Estimation of iron from various dietary sources by thiocyanate method.**

MSc SYLLABUS 2017-2018

St. Aloysius College, Jabalpur
Department of Chemistry and Biochemistry
According to Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
M.Sc. I SEMESTER
Course MCH 101 (PAPER I): Inorganic Chemistry

Maximum Marks 35

UNIT I

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

UNIT II

Reaction Mechanism of Transition Metal Complexes. 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 III

Metal-Ligand Bonding . Molecular orbital theory. Qualitative aspects of metal-ligand σ-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 IV

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

UNIT V

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 **and their applications**. Metal clusters: synthesis, reactivity and bonding.

Books Suggested

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetiochemistry, R.1. Carlin, Springer Verlag.
6. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.

M.Sc. SEMESTER I

Course MCH 102 (PAPER II): Organic Chemistry

Maximum Marks 35

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 and t**heir applications**, 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 π and σ bonds. Classical and nonclassical carbocations, norbornyl system, carbocation rearrangements.

UNIT V

Ultraviolet and Visible Spectroscopy. 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, **Comparision of UV-Vis and chiroptical spectroscopy**, deduction of absolute configuration, octant rule for ketones.

Books Suggested

1. Organic Chemistry, J. Claden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.
2. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, Wiley-Interscience.
3. Organic Chemistry, P.Y. Bruice, Pearson Education Asia.
4. Organic Chemistry, L.G. Wade, Jr., Pearson Education.
5. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
6. Organic Chemistry, J. McMurry, Thomson Asia.
7. Organic Chemistry, T.W.G. Solomons and C.B. Fryhle, John Wiley (Asia).
8. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
9. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.
10. Stereochemistry of Organic Compounds, E.L. Eliel and S.H. Wilen, John Wiley (Asia).
11. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
12. Stereochemistry of Organic Compounds, P .S. Kalsi, New Age International.
13. Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman and G.S. Kriz, Thomson, Brooks/Cole.
14. Organic Spectroscopy, W. Kemp, ELBS, Macmillan.
15. Spectrometric Identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C, Morrill, John Wiley
16. Application of Spectroscopy of Organic Compounds, J. R. Dyer, Prentice Hall.
17. Spectroscopic Methods in Organic Chemistry, D. H. Williams, I. Fleming, Tata McGraw-Hili.

M.Sc. I SEMESTER
Course MCH 103 (PAPER III): Physical Chemistry

Maximum Marks 35

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.

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistyry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R.Mc Ween y, ELBS.
5. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
6. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, McMillan.
7. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
8. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
9. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Introduction to Quantum Chemistry-R.K. Prasad, New Age Publication.

M.Sc. I SEMESTER
Course MCH 104 (PAPER IV): Spectroscopy

Maximum Marks 35

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. **Principle of Raman Effect** 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.

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton.
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
8. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH Oxford.
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
10. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, Harper & Row.

CONTINUOUS EVALUATION (Internal Assessment)

Course MCH 105 (a): Mathematics for Chemists

(For students without Mathematics in B.Sc.)

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.).

UNIT III

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 IV

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.

UNIT V

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.

Book Suggested

1. The chemistry Mathematics Book, E.Steiner, Oxford University Press.
2. Mathematics for chemistry, Doggett and Suiclific, Logman.
3. Mathematical for Physical chemistry : F. Daniels, Mc. Graw Hill.
4. Chemical Mathematics D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall.
6. Basic Mathematics for Chemists, Tebbutt, Wiley.
7. Mathematics for Chemists: Bhupendra Singh, Pragati Prakashan

CONTINUOUS EVALUATION (Internal Assessment)

Course MCH 105 (b) Biology for Chemists

(For students without Biology in B.Sc.)

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

Lipid. Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Liproproteins-compositiion and function, role in atherosclerosis. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism-boxidation of fatty acids.

UNIT IV

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 V

Nucleic Acids. Purine and pyrimidine bases of nucleic acids, base pairing via Hbounding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and trinucleoside.

Book Suggested

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, J. David Rawan, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley.

PRACTICAL COURSES
M.Sc. SEMESTER I
LABORATORY COURSES MCH 106, MCH 107 and MCH 108

Emphasis should be placed on physical principles, reaction chemistry and the technique involved in experiments. Attention should be placed on stoichiometric calculations and statistical analysis of results. In regular classes, each student should perform all the experiments as selected by the Department from the list in the syllabus. In examination, students should be given different experiments or combination of experiments.

Course MCH 106: Inorganic Chemistry (6 hours; 1 day)		Max. Marks 34
	Viva voce	6
	Two or three Experiments based on the following	28
(a)	Preparation	
(b)	Quantitative analysis	
(c)	Qualitative	
(d)	Spectral analysis of known compounds	

Course MCH 107: Organic Chemistry (6 hours; 1 day)		Max. Marks 33
	Viva voce	05
	Two or three Experiments based on the following:	28
(a)	Qualitative analysis	
(b)	Quantitative analysis	
(c)	Organic Synthesis	
(d)	Spectral analysis of known compounds	

Course MCH 108: Physical Chemistry (6 hours; 1 day)		Max. Marks 33
	Viva voce	5
	Two Experiments based on the following	28
(a)	Adsorption	
(b)	Phase Equilibria	
(c)	Chemical Kinetics	
(d)	Solutions	

Course MCH 106: Inorganic Chemistry

Qualitative and Quantitative Analysis

a. Insoluble- Oxides, sulphates and halides.
b. Separation and determination of two metal ions Cu-Ni, Ni-Zn, Cu-Fe etc. Involving volumetric and gravimetric methods.
c. ***Chromatography***

Separation of cations and anions by Paper Chromatography

Preparations

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

$[Ni(acac)_2(H_2O)_2]$

$[Ni(NH_3)_6]Cl_2$ cis-$K[Cr(C_2O_4)_2(H_2O)_2]$

trans-$K[Cr(C_2O_4)_2(H_2O)_2]$ **$K_3[Fe(C_2O_4)_3.3H_2O$**

$Fe_4[Fe(CN)_6]_3$

Interpretation of IR and Electronic Spectra of some known compounds

Course MCH 107: Organic Chemistry

Qualitative 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 tets. 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

Purification of compounds by TLC and column chromatography.

Aromatic electrophilic sustitutions:

Synthesis of m-dinitrobenzene from nitrobenzen

Preparation

Aspirin from salicylic acid

Phenyl azo β napthol dye

Quantitative Analysis

Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method

Column chromatography: Separation of leaf pigments

Interpretation of IR and Electronic Spectra of some known compounds

Course MCH 206: Physical Chemistry

A list of experiments under different headings is given below. Typical experiments are to be selected from each type.

Adsorption

1) To determine the Langmuir adsorption isotherm of acetic acid from aqueous solutions by charcoal
2) To investigate the adsorption of oxalic acid from aqueous solutions by charcoal and examine the validity of Freundlich adsorption isotherm

Phase Equilibria

(ii) To construct the phase diagram for three component system (e.g., chloroform-acetic acid-water).

Chemical Kinetics

(iv) Determine the rate constant of Hydrolysis of an ester as methyl acetate catalysed by an acid HCl and also the energy of activcation.

(v) Determine the rate constant of Hydrolysis of an ester as ethyl acetate catalysed by an NaOH(Saponification of ester) and also the energy of activcation.

(vi) Determination of the effect of (a) Change of temperature (b) Change of concentration of reactants and catalyst and (c) Ionic strength of the media on the velocity constant of hydrolysis of an ester/ionic reactions.

(iv) 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)

Solutions

(v) Determination of molecular weight of non-volatile and non-electrolyte/electrolyte by cryoscopic method

and to determine the activity coefficient of an electrolyte.

Polarimetry

(i) Enzyme kinetics -inversion of sucrose
(ii) To calculate specific rotation of sucrose

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.
2. Analytical Chemistry, S.M. Khopkar, New Age International Ltd., New Delhi.
3. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall
4. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall
5. Macroscale and Microscale Organic Experiments, K. L. Williamson, D. C. Heath.
6. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
7. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clarke, Adward Arnold.
8. Vogel's Textbook of Practical Organic Chemistry, ELBS.
9. F.G. Mann and B.C. Saunders, Practical Organic Chemistry, Orient Longman.
10. Findley's Practical Physical Chemistry, B. P. Levitt, Longman
11. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
12. Practical Physical Chemistry, A. M. James and F. E. Prichard, Longman

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as recommended by Central Board of Studies and approved by the Governor of M.P.

M.Sc. II SEMESTER
Course MCH 201 (PAPER I): Inorganic Chemistry

Maximum Marks 35

UNIT I

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**environmental factors, solvent** and 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 II

Reaction Mechanism of Transition Metal Complexes. 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 π-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

UNIT III

Metal-Ligand Bonding. Molecular orbital theory: Qualitative aspect of metal-ligand π-bonding in octahedral complexes, tetrahedral and square planar complexes.

Electronic Spectra and Magnetic Properties of Transition Metal Complexes. ***Introduction to Dq, B and β parameters***Calculations of Dq, B and β 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 IV

Metal π-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.

UNIT V

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.

Books Suggested

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements,N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetochemistry, R.L. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty, Pergamon.
7. Synthesis and characterization of some novel nitrosyl compounds, R. C. Maurya Pioneer Publications, Jabalpur, 2000.
8. Chemical Applications of Group Theory, F.A. Cotton, John Wiley.

M.Sc. SEMESTER II
Course MCH 202 (PAPER II): Organic Chemistry

Maximum Marks 35

UNIT I

Aliphatic Electrophilic Substitution. Bimolecular mechanisms, S_E2 and S_Ei mechanisms. The S_E1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and solvent polarity on the reactivity.

Aromatic Electrophilic Substitution. The arenium ion mechanism, orientation and reactivity. The ortho/para ratio, ipso attack. Vilsmeier reaction, Fries rearrangement.

UNIT II

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.

Electron spin resonance (ESR) spectroscopy. Electron paramagnetism, derivative curves, g values and hyperfine splitting.

UNIT III

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 IV

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.

UNIT V

*Infrared and Raman Spectroscopy.***Principle of IR spectroscopy and selection rule**.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.

Books Suggested

1. Organic Chemistry, J. Claden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.
2. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, Wiley-Interscience.
3. Organic Chemistry, P.Y. Bruice, Pearson Education Asia.
4. Advanced Organic Chemistry, F. A. Carey and R. J. Sundberg, Plenum.
5. Organic Chemistry, J. McMurry, Thomson Asia.
6. Organic Chemistry, T.W.G. Solomons and C.B. Fryhle, John Wiley (Asia).
7. Organic Chemistry, L.G. Wade, Jr., Pearson Education.
8. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
9. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall.
10. Stereochemistry of Organic Compounds, E.L. Eliel and S.H. Wilen, John Wiley (Asia).
11. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
12. Stereochemistry of Organic Compounds, P .S. Kalsi, New Age International.
13. Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman and G.S. Kriz, Thomson, Brooks/Cole.
14. Organic Spectroscopy, W. Kemp, ELBS, Macmillan.
15. Spectrometric Identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C, Morrill, John Wiley
16. Application of Spectroscopy of Organic Compounds, J. R. Dyer, Prentice Hall.
17. Spectroscopic Methods in Organic Chemistry, D. H. Williams, I. Fleming, Tata McGraw-Hili.

M.Sc. II SEMESTER

Course MCH 203 (PAPER III): Physical Chemistry

Maximum Marks 35

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

Macromolecules and Colloids. Polymers, types of polymers, kinetics of polymerization, mechanism of polymerization reactions. Molecular mass of macromolecues, number and mass average molecular mass; molecular mass determination (osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain structures and their configuration.

Emulsions. Theories of emulsification, coagulation, slow and rapid coagulation. Kenitics of coagulation. Von Smoluchouski equation and its verification.

UNIT V

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.

Books Suggested

1. Physical Chemistry, P. W. Atkins, ELBS. .
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata McGraw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentce Hall.
4. Coulson's Valence, R. McWeeny, ELBS.
5. Chemical Kinetics, K. J. Laidler, Mcgraw-Hill.
6. Kinetics and Mechanism of Chemical Transformations, J. Rajaraman and J. Kuriacose, McMillan.
7. Micelles, Theoretical and Applied Aspects, V. Moroi, Plentm
8. Modern Electrochemistry Vol. I and Vol. II, J.O.M. Bockris and A.K.N. Reddy, Plenum.
9. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Physical Chemistry, W.J. Moore, Prentice-Hall, India.
11. Physical Chemistry, P.C. Rakshit.
12. Quantum Chemistry, Eyring and Kimball.

M.Sc. II SEMESTER

Course MCH 204 (PAPER IV): Spectroscopy & Diffraction Methods

Maximum Marks 35

UNIT I

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.

UNIT II

X-ray Diffraction. **Basic Principle** 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 III

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.

UNIT IV

Biological Cell and its Constituents. Biological cell. Structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coil transition.

Bioenergetics. Standard free energy change in biochemical reactions; exergonic and endergonic reactions. Hydrolysis of ATP. Synthesis of ATP from ADP.

Statistical Mechanics in Biopolymers. Chain configuration of macromolecules, statistical distribution end to end dimensions. Polypeptide chain binding and proteins, introduction to protein folding problem.

UNIT V

Thermodynamics of Biopolymer Solutions. Thermodynamics of biopolymer solutions, osmotic pressure, membrane equilibrium.

Transport of Ions. Biopolymers and their molecular weights. Structure and functions of cell membrane, ion transport through cell membrane, Nerve conduction; Evaluation of size, shape and molecular weight of biopolymers by various experimental techniques.

Books Suggested

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L. Ho, Wiley Interscience.
3. Physical Methods in Chemistry, R.S. Drago, Saunders College.
4. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw Hill.
5. Basic Principles of Spectroscopy, R. Chang, McGraw Hill.
6. Introduction to Photoelectron Spectroscopy: P. K. Ghosh, John Wiley.
7. Principles of Biochemistry, A. L. Lehninger, Worth Publishers.
8. Biochemistry, L.Stryer, W.H.Freeman.
9. Biochemistry, J. David Rawn, Neil Patterson.
10. Biochemistry, Voet and Voet, John Wiley.
11. Outlines of Biochemistry, E. E. Conn and P. K. Stumpf, John Wiley.
12. Bioorganic Chemistry: A Chemical Approach to Enzyme Action, H. Dugas and C. Penny, Springer-Verlag.
13. Macromolecules: Structure and Function, F. Wold, Prentice Hall.
14. Fundamentals of molecular spectroscopy, C.N. Banwell, Tata McGraw-Hill, New Delhi.
15. Instrumental Methods of Analysis, Willard, Meritt and Dean.

CONTINUOUS EVALUATION (Internal Assessment)

Course MCH 205: Computers for Chemists

This is a theory cum-laboratory course with more emphasis on laboratory work.

UNIT I

Introduction to Computers and Computing. Basic structure and functioning of computer with a PC as illustrative example. Memory I/O devices. Secondary storage Computer languages. Operating systems with DOS as an example Introduction to UNIX and WINDOWS. Principles of programming Alogrithms and flow-charts.

UNIT II

Computer Programming in FORTRAN/C/BASIC. (the language features are listed here with reference to FORTRAN. The instructor may choose another language such as BASIC or C the features may be replaced appropriately). Elements of the compute language. Constants and variables. Operations and symbols Expressions. Arithmetic assignment statement. Input and output Format statement. Termination statements. Branching statements as IF or GO TO statement. LOGICAL variables. Double precession variables. Subscripted variables and DIMENSION. DO statement FUNCTION AND SUBROUTINE. COMMON and DATA statement (Student learn the programming logic and these language feature by hands on experience on a personal computer from the beginning of this topic.)

UNIT III

Programming in Chemistry. Developing of small computer codes using any one of the languages FORTRAN/C/BASIC involving simple formulae in Chemistry, such as Van der Waals equation. Chemical kinetics (determination of Rate constant) Radioactive decay (Half Life and Average Life). Determination Normality, Molarity nd Molality of solutions. Evaluation Electronegativity of atom and Lattice Energy from experimental determination of molecular weight and percentage of element organic compounds using data from experimental metal representation of molecules in terms of elementary structural features such as bond lengths, bond angles.

UNIT IV

Use of Computer programmes. Operation of PC. Data Processing. Running of standard Programs and Packages such as MS WORD, MS EXCEL -special emphasis on calculations and chart formations. X-Y plot. Simpson's Numerical Integration method. Programmes with data preferably from physical chemistry laboratory.

UNIT V

Internet. Application of Internet for Chemistry with search engines, various types of files like PDF, JPG, RTF and Bitmap. Scanning, OMR, Web camera.

Book Suggested

1. Fundamentals of Computer : V. Rajaraman, Prentice Hall.
2. Computers in Chemistry : K.V. Raman, Tata Mc Graw Hill).
3. Computer Programming in FORTRAN IV-V Rajaraman, Prentice Hall.
4. Computers and Common Sense, R. Hunt and J. Shelley, Prentice Hall.
5. Computational Chemistry, A.C. Norris.
6. Microcomputer Quantum Mechanics, J.P. Killngbeck, Adam Hilger.
7. An Introduction to Digital Computer Design, V. Rajaraman and T. Radhakrishnan, Prentice Hall.

M.Sc. SEMESTER II

LABORATORY COURSE MCH 206, MCH 207 and MCH 208

Emphasis should be placed on physical principles, reaction chemistry and the technique involved in experiments. Attention should be placed on stoichiometric calculations and statistical analysis of results. In regular classes, each student should perform all the experiments as selected by the Department from the list in the syllabus. In examination, students should be given different experiments or combination of experiments.

Course MCH 206: Inorganic Chemistry (6 hours; 1 day)		Max. Marks 34
	Viva voce	6
	Two or three Experiments based on the following	28
(a)	Chromatographic separation	
(b)	Synthesis	
(c)	Spectral analysis of known compounds	

Course MCH 207: Organic Chemistry (6 hours; 1 day)		Max. Marks 33
	Viva voce	5
	Two or three Experiments based on the following	28
(a)	Synthesis	
(b)	Quantitative analysis	
(c)	Spectral analysis of known compounds	

Course MCH 208: Physical Chemistry (6 hours; 1 day)		Max. Marks 33
	Viva voce	5
	Two Experiments based on the following	28
(a)	Electrochemistry	
(b)	Potentiometry	
(c)	Polarimetry	

Course MCH 206: Inorganic Chemistry

Chromatography

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

Preparations

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

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

b. $[Ni(NH3)_6]Cl2$
c. $[Ni(dmg)_2]$
d. $[Co(acac)_2(H_2O)_2]$

Course MCH 207: Organic Chemistry

Organic Synthesis

Oxidation reaction:

Synthesis of 9,10-anthraquinone by oxidation of anthracene by chromium trioxide

Synthesis of 4-nitrobenzaldehyde by oxidation of 4-nitrotoluene by chromium trioxide

Cannizzaro reaction

Synthesis of benzyl alcohol from benzaldehyde

Claisen-Schmidt reaction:

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

Sandmeyer reaction:

Synthesis of 2-chloroanthranilic acid from anthranilic acid

Methylation:

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

Synthesis :

1. Acetanilide drom aniline
2. o-chlorotolune from 0-toluinide
3. p-nitroacetanildide from acetanild
4. dihydropyrimidinon
5. 1,1-bis-2-napthol from napthol-2

Quantitative Analysis

Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method
Determination of aromatic amines or phenols using bromate-bromide mixture
Determination of number of double bonds in an organic compound
Determination of percentage or number of ester groups in an organic compound by saponification

Synthesis of Biodiesel

Interpretation of NMR and mass spectra of some known compounds

Course MCH 208: Physical Chemistry

A list of experiments under different headings is given below. Typical experiments are to be selected from each type.

Adsorption

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

Electrochemistry

A. Conductometry

(i) Determination of the velocity constant, order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.

(ii) Determination of solubility and solubility product of sparingly soluble salts (e.g., $PbSO_4$, $BaSO_4$) conductometrically.

(iii) Determination of the strength of strong and weak acids in a given mixture conductometrically.

(iv) Determination of the activity coefficient of zinc ions in the solution of 0.002 M zinc sulphate using Debye-Huckel's limiting law.

B. Potentiometry/pH merry

1. Determination of strengths of halides in a mixture potentiometrically.
2. Determination of the valency of mercurous ions potentiometrically.
3. Determination of the strength of strong and weak acids in a given mixture usi potentiometer/pH meter.
4. Determination of activity and activity coefficient of electrolytes.

Polarimetry

1. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.
2. Enzyme kinetics -inversion of sucrose

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.
2. Analytical Chemistry, S.M. Khopkar, New Age International Ltd., New Delhi.
3. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall
4. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall
5. Macroscale and Microscale Organic Experiments, K. L. Williamson, D. C. Heath.
6. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
7. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clarke, Adward Arnold.
8. Vogel's Textbook of Practical Organic Chemistry, ELBS.
9. F.G. Mann and B.C. Saunders, Practical Organic Chemistry, Orient Longman.
10. Findley's Practical Physical Chemistry, B. P. Levitt, Longman
11. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
12. Practical Physical Chemistry, A. M. James and F. E. Prichard, Longman

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M.Sc. SEMESTER III
Course MCH 301 (PAPER I): Inorganic Chemistry

Maximum Marks 35

UNIT I

Group theory. Matrix representation of point groups, Character of a representation, reducible and irreducible representations. The great orthogonality theorem (without proof) and its importance, construction of character tables for C_{2v}, and C_{3v} point groups, importance of character tables.

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^-, β-ketoenolate and related ligands, nitrate ion and corboxylates.

UNIT III

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.**NMR-Principle and instrumentation, Medicinal application of NMR-CT Scan**

UNIT IV

Bioinorganic Chemistry. ***Enzymes- Structure, Types, Properties and functions Enymes***-Metal containing enzymes: Carboxypeptidase-A, Carbonic anhydrase, arginase, urease, DNA polymerase, phosphoglucomutase (glucose storage): structure and reactivity

UNIT V

*Transport and Storage of Dioxygen:***structure and function of blood**. structure and function of hemoglobin, myoglobin, hemocyanins and hemerythrin. Poisoning towards hemoglobin and myoglobin.

Book Suggested

1. Chemical Applications of Group Theory, F.A. Cotton, John Wiley
2. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
3. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
4. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.
5. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
6. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
7. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
8. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
9. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.

M.Sc. SEMESTER III

Course MCH 302 (PAPER II): Organic Chemistry

Maximum Marks 35

UNIT I

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. **NMR Principle and Instrumentation**Nuclear Overhauser effect (NOE). FT technique.

UNIT II

Photochemistry: Part I. Photochemical Reactions. Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield.

Photochemistry of Carbonyl Compounds. Norrish type I and type II reactions; α-cleavage of cyclic and acyclic, β,γ- unsaturated and α,β-unsaturated compounds. Dimerisation, and the Patterno-Büchi reaction. Rearrangement of dienones. Photoreduction.**Application of photochemical reaction in everyday life**

UNIT III

Photochemistry: Part II. Photochemistry of Alkenes. Geometrical isomerisation, dimerisation reactions, rearrangement of 1,4- and 1,5- dienes. Photooxidation.

Photochemistry of Aromatic Compounds. Photo-Fries rearrangement, photoisomerization. Barton reaction. Singlet molecular oxygen reactions.

UNIT IV

*Pericyclic Reactions: Part I. Molecular orbitals and their symmetry.****Molecular orbitals and its postulate***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.

Books Suggested

1. Essentials of Molecular Photochemistry, A Gilbert and J. Baggott, Blackwell Scientific Publication.
2. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
3. Introductory Photochemistry, A. Cox and t. Camp, McGraw Hill.
4. Photochemistry, R.P. Kundall and A. Gilbert. Thomson Nelson.
5. Organic Photochemistry, J. Coxon and B.halton, Cambridge University Press.
6. Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman and G.S. Kriz, Thomson, Brooks/Cole.
7. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
8. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler adn T.C. Morrill, John Wiley.
10. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
11. Pericyclic Reactions, S. M. Mukherji, Macmillan, India.
12. Organic Chemistry, L.G. Wade, Jr., Pearson Education.
13. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, Wiley-Interscience.

M.Sc. SEMESTER III

Course MCH 303 (PAPER III): Physical/Solid State Chemistry

Maximum Marks 35

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.***Catalyst and its Properties**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.***Crystal Lattice and structure of SCC, BCC.FCCPerfect** 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 solids-Band theory; band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors.**Use of semiconductors and diodes in electronic equipments**

Books Suggested.

1. Solid state chemistry and its applications, A.R. West. Peenum.
2. Principles of the Solid State, H.V. Keer, Wiley Eastern.
3. Solid State Chemistry, N.B. Hannay.
4. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.

M.Sc. SEMESTER III

Course MCH 304B (ELECTIVE PAPER IV): Analytical Chemistry

Maximum Marks 35

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. ***Brief review of paper chromatography , TLC and column 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**Industrial application of ion exchangers.**

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

theory*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

Concentration terms and titration *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.

Books Suggested

1. D.A. Skoog, D.M. West, F.J. Holler and S.R. Crouch, Fundamentals of analytical chemistry, Thomson Brooks/Cole, Singapore.
2. D.C. Harris, Quantitative chemical analysis, W.H. Freeman and Co., New York.
3. J.D. Christian, Analytical Chemistry, Wiley, New York.
4. Principles and Practice of Analytical Chemistry, F.W. Fifield and D. Kealey, Blackwell Publishing.
5. S.M. Khopkar, Basic concepts of analytical chemistry, Wiley Eastern, New Delhi.
6. S.M. Khopkar, Analytical chemistry of macrocyclic and supramolecular compounds, Narosa Publishing House, New Delhi.
7. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.

M.Sc. SEMESTER III

Course MCH 305D (ELECTIVE PAPER V): Medicinal Chemistry

Maximum Marks 35

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) **side effect of antibiotics . most common brands of antibiotics(composition)**

UNIT IV

Antifungal polyenes, Antibacterials. Ciprofloxacin, Norfloxacin, Antiviral. Acyclovir Antimalarials. Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine**side effect of antibacterial , antivirals and antimalarial. Most common brands of antibacterial, antivirals and antimalarialcomposition)**

UNIT V

Non-steroidal Anti-inflammatory Drugs. Diclofenac Sodium, Ibuprofen and Netopam Antihistaminic and antiasthmatic agents : Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.**side effect of anti-inflammatory drugs. Most common brands of anti-inflammatory drugs**(**composition)**

Books Suggested

1. Introduction to Medicinal Chemistry, A Gringuage, Wliey-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed. R.F. Dorge.
3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age International.
4. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
5. Strategies for Organic Drug Synthesis and design, D. Lednicer, John wiley.

PRACTICAL COURSES

M.Sc. SEMESTER III

LABORATORY COURSES MCH 307, MCH 308, MCH 309

Emphasis should be placed on physical principles, reaction chemistry and the technique involved in experiments. Attention should be placed on stoichiometric calculations and statistical analysis of results. In regular classes, each student should perform all the experiments as selected by the Department from the list in the syllabus. In examination, students should be given different experiments or combination of experiments.

Course MCH 307: Inorganic Chemistry (6 hours; 1 day)		Max. Marks 34
	Viva voce	6
	Two or three Experiments based on the following	28
(a)	Synthesis	
(b)	Quantitative analysis	
(c)	Qualitative	
(d)	Spectral analysis of known compounds	

(iii) **Course MCH 308: Organic Chemistry** (6 hours; 1 day)		Max. Marks 33
	Viva voce	5
	Two or three Experiments based on the following	28
(a)	Synthesis	
(b)	Quantitative analysis	
(c)	Qualitative analysis	
(d)	Spectral analysis of known compounds	

(iii) **Course MCH 309: Physical Chemistry** (6 hours; 1 day)		Max. Marks 33
	Viva voce	5
	Two Experiments based on the following	28
(a)	Electrochemistry	
(b)	Potentiometry	
(c)	Polarimetry	

Course MCH 307: Inorganic Chemistry

Synthesis

Synthesis of selected inorganic compounds and their studies by measurements of decomposition temperatures and molar conductance, and IR electronic spectra.

1. trans-Bis(glycinato)copper(II) and estimation of copper
2. Potassium tris(oxalato)ferrate, $K_3[Fe(C_2O_4)_3]$ and determination of oxalate using permanganate.
3. Preparation of Tetraammine copper (II) Sulphate mono hydrate$[Cu(NH_3)_4]SO_4.H_2O$ and gravimetric estimation of Cu(II)

Interpretation of ESR spectra of some known coordination compounds.

Course MCH 308: Organic Chemistry

Qualitative Analysis

Separation, purification and systematic identification of the components of a mixture of three organic compounds (solids and liquids). Preparation of one derivative of each compound. Use of TLC for ascertainment of purity of compounds.

Multi-step Synthesis

This exercise should illustrate the use of organic reactions/ diverse conditions and principles for organic synthesis. Purification of compounds by chromatographic techniques.

Photochemical reaction

Benzophenone $\rightarrow$ benzpinacol $\rightarrow$ benzpinacolone

Rearrangement

Benzaldehyde $\rightarrow$ benzoin $\rightarrow$ benzil $\rightarrow$ benzilic acid

Quantitative Analysis

1. Estimation of Protein by Lowry's Method.
2. Estimation of Carbohydrate by Anthrone's Method.
3. Isolation of caffeine and other Alkaloids from tea

Spectral Analysis

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

Course MCH 309: Physical Chemistry

Potentiometry

1. Acid-base titration
2. Titration of mixture of acids
3. Redox titrations
4. Determination of redox potential of Fe(III)/Fe(II) system

Conductivity

5. Verification of Onsager equation for a strong electrolyte
6. Determination of dissociation constant of a weak acid
7. Acid-base titrations
8. Replacement titration
9. Solubility of sparingly a soluble salt
10. Basicity of an organic acid

Spectrophotometry

11. Verification of Beer-Lambert law
12. Determination of pKa of an acid-base indicator such as Methyl Red

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.
2. Analytical Chemistry, S.M. Khopkar, New Age International Ltd., New Delhi.
3. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall
4. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall
5. Macroscale and Microscale Organic Experiments, K. L. Williamson, D. C. Heath.
6. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
7. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clarke, Adward Arnold.
8. Vogel's Textbook of Practical Organic Chemistry, ELBS.
9. F.G. Mann and B.C. Saunders, Practical Organic Chemistry, Orient Longman.
10. Findley's Practical Physical Chemistry, B. P. Levitt, Longman
11. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
12. Practical Physical Chemistry, A. M. James and F. E. Prichard, Longman

St. Aloysius College, Jabalpur
Department of Chemistry and Biochemistry
According to Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.

M.Sc. SEMESTER IV
Course MCH 401 (PAPER I): Inorganic Chemistry

Maximum Marks 35

UNIT I

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

UNIT II

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. ***applications***

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 $D_{\infty h}$ point groups.

UNIT IV

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

Unit V

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.

Books Suggested

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic Biochemistry vols I and II. ed. G.L. Eichturn, Elsevier.
4. Progress in Inorganic Chemistry, Vols 18 and 38 ed. J.J. Lippard, Wiley, Environmental Chemistry, S. E. Manahan, Lewis Publishers.

M.Sc. SEMESTER IV
Course MCH 402 (PAPER II): Organic Chemistry

Maximum Marks35

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).**Industrial and pharmaceutical application of mass spectroscopy**

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

UNIT IV

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 V

Enzymes. Properties of enzymes, catalytic power, specificity and regulation. Fischer's lock and key and Koshland's induced fit hypothesis. Identification of active site by the use of inhibitors.

Kinetics. Transition-state theory. Michaelis-Menten equation, and Lineweaver-Burk plot. Enzyme mechanisms for chymotrypsin, lysozyme and carboxypeptidase A.

Coenzyme chemistry. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD^+, $NADP^+$, FMN, FAD, and vitamin B_{12}.

Methods of immobilization of enzymes. Effect of enzyme immobilization on enzyme activity. **Various types of enzymes used in different industries (esp. fermentation)**

Books Suggested

1. Introduction to Spectroscopy, D.L. Pavia, G.M. Lampman and G.S. Kriz, Thomson, Brooks/Cole.
2. Organic Spectroscopy, W. Kemp, ELBS, Macmillan.
3. Spectrometric Identification of Organic Compounds, R. M. Silverstein, G.C. Bassler and T.C, Morrill, John Wiley
4. Spectroscopic Methods in Organic Chemistry, D. H. Williams, I. Fleming, Tata McGraw-Hili.
5. Application of Spectroscopy of Organic Compounds, J. R. Dyer, Prentice Hall.
6. Mass Spectrometry, E. de Hoffmann and V. Stroobant, Wiley, Chichester.
7. Ionization Methods in Organic Mass Spectrometry, A.E. Ashcroft, Royal Society of Chemistry, Cambridge.
8. Organic Chemistry, J. Claden, N. Greeves, S. Warren, P. Wothers, Oxford University Press.
9. Organic Chemistry, L.G. Wade, Jr., Pearson Education
10. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, Wiley-Interscience.
11. Biochemistry, D. Voet and J.G. Voet, John Wiley.
12. Principles of Biochemistry, A.L. Lehninger, D.L. Nelson and M.M. Cox, CBS Publishers, Delhi.
13. Immobilized Enzymes: An Introduction and Applications in Biotechnology, Michael D. Trevan, John Wiley.

M.Sc. SEMESTER IV

Course MCH 403 (PAPER III): Physical Chemistry

Maximum Marks 35

UNIT I

Nuclear Magentic Resonance Spectroscopy. Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurement, factors influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant, J. Exchange phenomenon.

UNIT II

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 III

Photochemistry. Thermal and photochemical reactions. Laws of photochemistry, quantum yield and its determination, abnormal quantum yield, primary and secondary processes; Fluorescence and phosphorescence, chemiluminescence, photosensitation. Photogalvanic and photcatalytic effects.

UNIT IV

Steric and Conformational Properties. Various types of steric strain and their influence on reactivity. Steric acceleration. Primary and secondary steric effects, LFER. Conformational barrier to bond rotation-spectroscopic detection of individual conformers. Winstein-Holness and Curtin-Hammett principle.

UNIT V

Nucleophilic and Electrophilic Reactivity. Structural and electronic effects on S_N1 and S_N2 reactivity. Solvent effects on nucleophilic displacements. Kinetic isotope effects. Intramolecular assistance. Electronic effects and reactivity in S_N2 reaction, curve-crossing model. Relationship between polar and electron transfer reactions.

Books Suggested

1. Quantum Chemistry, Eyring and Kimball.
2. Quantum Mechanics, Hanna.

3. Introduction to Quantum Chemistry, A.K. Chandra.
4. Physical Chemistry, P.C. Rakshit.
5. Physical Chemistry, P.W. Atkins, ELBS.
6. Solid State Chemistry, N.B. Hannay, Prentice-Hall, India
7. Fundamentals of Molecular Spectroscopy, C.N. Banwell, Tata McGraw-Hill, New Delhi.
8. Basic Physical Chemistry, W.J. Moore, Prentice-Hall, India.
9. Physical Methods in Chemistry, R.S. Drago.
10. Applied Electron spectroscopy for Chemical Analysis, H. Windawi and F.L. Ho, editors, Wiley Interscience.
11. Introduction to Molecular Spectroscopy, G.M. Barrow, McGraw-Hill.
12. Basic Principles of Spectroscopy, R. Chang, McGraw-Hill.
13. Physical Organic Chemistry, Jack Hine, McGraw-Hill.
14. Mechanism-An Introduction to the Study of Organic Reactions, R.A. Jackson, Oxford Chemistry Series.
15. Structure and Mechanism in Organic Chemistry, C.K. Ingold, G. Bell & Sons.
16. Physical Organic Chemistry, N.S. Issacs, ELBS, Longman.

M.Sc. SEMESTER IV

Course MCH 404B (ELECTIVE PAPER IV): Polymers

Maximum Marks35

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. **Application of polymers and its products in various sector**

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. **Recent advanced in the field of polymer**

Books Suggested

1. Textbook of Polymer Science, F.W. Billmeyer, Jr., Wiley.
2. Polymer Science, V.R. Gwariker, N.V. Viswanathan and J. Sreedhar, Wiley-Eastern.
3. Functional Monomers and Polymers, K. Takemoto, Y. Inaki and R.M. Ottanbrite.

4. Contomporary Polymer Chemistry, H.R. Alcock and F.W. Lambe, Prentice Hall.
5. Physics and Chemistry of Polymers, J.M.G. Cowie, Blackie Academic and Professional.

M.Sc. SEMESTER IV

Course 405C (ELECTIVE PAPER V): Environmental Chemistry

Maximum Marks 35

UNIT-I

Atmosphere. Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphure, phosphorus oxygen. Residence times.

Atmospheric Chemistry. Sources of trace atmospheric constituents : nitrogen oxides, sulphure dioxide and other sulphure compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons.

Tropospheric Photochemistry. Mechanism of Photochemical decomposition of NO2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO2 and NO2. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.

UNIT-II

Air Pollution. Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health.

Acid Rain. Definition, Acid rain precursors and their aqueous and gas phase atmospheric Oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO2 and NOx. Acid rain control strategies.

Stratospheric Ozone Depletion. Mechanism of Ozone formation, Mechanism of catalytic Ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies.

Green House Effect. Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.

Urban Air Pollution. Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.**Various agencies in Jabalpur city for pollution control**

UNIT-III

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.Narmada River , its components and extent of pollution

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.**Presence of arsenic and fluoride in drinking water in Jabalpur Mandla region and its harmful effects**

Toxic Organic Compound. Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.

Polychlorinated biphenyls. Properties, use and environmental continuation and effects.

Polynuclear Aromatic Hydrocarbons. Source, structures and as pollutants.

UNIT-V

*Soil and Environmental Disasters.***Soil type in Jabalpur region and crops grown**Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic an metals. Methods of re-mediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog.

Books Suggested

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
2. Chemistry of Atmospheres, R.P. Wayne, Oxford.
3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.

M.Sc. SEMESTER IV
LABORATORY COURSE MCH 407

Emphasis should be placed on physical principles, reaction chemistry and the technique involved in experiments. Attention should be placed on stoichiometric calculations and statistical analysis of results. In regular classes, each student should perform all the experiments as selected by the Department from the list in the syllabus. In examination, students should be given different experiments or combination of experiments.

Course MCH 407: Inorganic Chemistry (6 hours; 1 day)		Max. Marks 34
	Viva voce	6
	Two or three Experiments based on the following	28
(a)	Spectrophotometric	
(b)	Cyclic voltammetric	
(c)	Spectral analysis	

Course MCH 408: Organic Chemistry (6 hours; 1 day)		Max. Marks 33
	Viva voce	5
	Two or three Experiments based on the following	28
(a)	Synthesis	
(b)	Quantitative	
(c)	Spectral analysis	

Course MCH 409: Physical Chemistry (6 hours; 1 day)		Max. Marks 33
	Viva voce	5
	Two Experiments based on the following	28
(a)	Chemical Kinetics	
(b)	Spectrophotometry	
(c)	Electronics	

Course MCH 407: Inorganic Chemistry

Spectrophotometric Determination

1. Determination of the pH of a given solution by spectrophotometry using methyl red indicator
2. To separate and estimate Mg(II) and Fe(II) by solvent extraction method

Model Experiments on Cyclic Voltammetry

Acquaintance with cyclic voltammetry experiments involving use of $K_3[Fe(CN)_6]$

Water Analysis

1. To determine type and extent of alkalinity of given water samples by using HCl (when P>M/2)

2. To determine type and extent of alkalinity of given water samples by using HCl (when P<M/2)

Interpretation of NMR spectra of known compound

Course MCH 408: Organic Chemistry

Multi-step Synthesis

Heterocyclic compounds

Phenylhydrazine → acetophenone phenylhydrazone → 2-phenylindole

Ethyl acetoacetate → 3-methyl-1-phenylpyrazol-5-one → antipyrin (phenazone)

Benzaldehyde → benzoin → benzil → 5, 5-diphenylhydantoin

Mixed principles

Chlorobenzene → 1-chloro-2,4-dinitrobenzene → 2,4-dinitrophenylhydrazine

Quantitative Analysis

Spectrophotometric (colorimetric) determination of glucose by Fehling reaction

Determination of vitamin C in drug formulations and in fruits

Spectral Analysis

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

Course MCH 409: Physical Chemistry

Enzyme Kinetics

1. To study the effect of temperature on amylase enzyme activity and determine its optimum pH2. To study the effect of substrate concentration on enzyme activity

3. To study the effect of enzyme concentration on enzyme activity.

Spectrophotometry

1. Determination of stability constant of Fe(III)-salicyclic acid complex

Chemical Kinetics

2. Determination of order of $S_2O_8^{2-}$—I^- reaction
3. Determination of energy of activation of $S_2O_8^{2-}$—I^- reaction
4. Studies on the effect of variation of ionic strength on the rate of $S_2O_8^{2-}$—I^- reaction

5. Ester hydrolysis catalysed by a base
6. Kinetics of acid-catalysed reaction between acetone-iodine

Electronics

7. Voltage measurement with CRO
8. Measurement of e.m.f. with thermocouple
9. To plot the characteristic curve of a diode

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R. C. Denney, G. H. Jeffery and J. Mendham, ELBS.
2. Analytical Chemistry, S.M. Khopkar, New Age International Ltd., New Delhi.
3. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall
4. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice Hall
5. Macroscale and Microscale Organic Experiments, K. L. Williamson, D. C. Heath.
6. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
7. Handbook of Organic Analysis- Qualitative and Quantitative, H. Clarke, Adward Arnold.
8. Vogel's Textbook of Practical Organic Chemistry, ELBS.
9. F.G. Mann and B.C. Saunders, Practical Organic Chemistry, Orient Longman.
10. Findley's Practical Physical Chemistry, B. P. Levitt, Longman
11. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
12. PracticalPhysicalChemistry,A.M.JamesandF.E.Pri