Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.Final Semester: **III**

SUBJECT: **CHEMISTRY** PAPER: **I**

TITLE: **Fundamentals of Pharmaceutical Chemistry**

Maximum Marks: **140**

SYLLABUS

1. Introduction to drugs :

Definition of pharmaceutical chemistry, Nature & source of drugs. Some important terminologies used in pharmaceutical chemistry-pharmacy, pharmacology, medicinal chemistry, pharmacodynamic, pharmacokinetics, molecular pharmacology, pharmacophore, antimetabolites, actimycetes, chemotherapy, pharmacopoeia, Pharmecognosy, Pharmacotherapeutics, classification and nomenclature of drugs, prodrugs and soft drugs.

2. Drugs design :

(A) Development of new drugs, Drugs discovery without lead (eg. Penicillin). Concept of bio-active compounds, drug design, methods for Lead identification, Lead modification, SAR (Structure Activity Relationship). QSAR-Hansh equation, Hansh analysis method, free-Wilson analysis method.

(B) Theories of drug activity-clark occupancy theory, occupation theory, rate theory, induced fit theory, Thermopeutic ratio (derivation, numerical excluded) physico-chemical parameters.

3. Pharmacokinetics :

(A) Definition, drug absorption, drug receptor interaction, basic ligand concept, agonist, antagonist, partial agonist, inverse agonist, drug distribution, drug elimination, drug disposition.

(B) Introduction to Pharmacokinetic, parameters (volume of distribution, clearance, bioequivalence), factors governing volume of drug distribution factors affecting absorption. Bioavailability, use of pharmacokinetics in drug development process.

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4. **Pharmacodynamics :**

(A) Definition, enzyme stimulation, enzyme inhibition, antidiabetic drugs-Introduction, mode of action of insulin & metformine.

(B) Xenobiotics, detoxication - Definition, site of detoxication, mechanism of detoxication oxidation, reduction, hydroxylation,hydrolysis, conjugation, detoxication of cyanide, general introduction of toxicological study of drugs.

5. **Storage & applications :**

Factors affecting stability of medication on storage, temperature effect, humidity effect, effect of gases, effect of light, container, Encapsulation. Application of pharmaceutical chemistry

Books Suggested :

1. *Fundamental Concept of Applied Chemistry* - Jayshree Ghosh.
2. *Medicinal Chemistry-Ashutosh*, New Age International Publishers.
3. *A Textbook of Pharmaceutical Chemistry* - Jayshree Ghosh.
4. *Foye's Medicinal Chemistry* - Lemke Williams.
5. *Pharmaceutical Chemistry Inorganic* - G.R. Chatwal, Himalaya Publishing House.
6. *Text Book of Biochemistry* - D.M. Vasudeven, J.P. Publication.
7. *Pharmacology* - H.P. Rang, M.M. Dalp, P.K. Moora, J.M. Ritter.

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: FINAL **Semester III**

SUBJECT: CHEMISTRY **PAPER: II**

TITLE: Biochemistry

Max. Marks: **140**

SYLLABUS

1. ***WATER, pH & BUFFER :***
   Water as a medium for biological reaction, concept of pH in terms of biological system, effect of pH on a biomolecules, biological buffers system.

   Bonding in biomolecules - H-bond, vander waal interaction, ionic bond, hydrophobic attraction, glycosidic linkage, peptide bond, phosphodiester linkage

2. ***BIOENERGETICS***
   Concept of energy, thermodynamic principles (without deviation), thermodynamics state function, high energy phosphate compounds, hydrolysis of phosphate bonds, redox potential, ETC, oxidative & substrate level phosphorylation.

3. ***METABOLISM OF BIOMOLECULES***
   Carbohydrate Metabolism - Glycolysis, oxidation of pyruvate to acetyl CoA, Kreb's cycle, Gluconeogenesis, glycogenesis, glycogenolysis, HMP shunt.
   Lipid - TG Hydrolysis, β Oxidation of FFA, Ketone bodies metabolism.
   Amino Acid: Transamination, Deamination, Decarboxylation, formation of Urea.

4. ***ENZYMES***
   Properties, classification & nomenclature, activation energy, transition state theory, concept of active site, theories for enzymes-substrate complex formation. Enzyme specificity. Metallo enzymes, Enzyme Inhibition.
   Mechanism of Enzyme Carboxypeptidase, Ribonuclease, Chymotrypsin, Lysozyme.
   Enzymes Catalysis: Acid-base catalysis, covalent catalysis with nature of catalysed and uncatalysed reaction.
   Enzyme Kinetics: Michaelis-menten equation line weaver – Burk equation, kinetics for competitive, non competitive and uncompetitive inhibitor.
   Bisubstrate reaction, enzyme isolation & purification, enzyme immobilization.

5. ***BIOCHEMICAL FUNTIONS OF INORGANIC IONS***
   Role of Ca^{2+}, K^{+}, Na^{+}, Mg^{2+}, Fe^{2+} in living system & their requirements and their application in biological system.

Books Suggested:

1. *Lehninger Principles of Biochemistry*: Nelson D.L. & Cox M.M. CBS Publication (2000).
2. *Enzyme* (*Biochemistry*): Trevor Palmer.
3. *Biochemistry:* Voet D. & Voet J.G., John Wiley & Sons.
4. *Harper's Ilustrated Biochemistry*: Lange Publication.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. : FINAL Semester: **III**

SUBJECT:**CHEMISTRY** PAPER: **III**

TITLE: Spectroscopy Diffraction Techniques and Solid State Chemistry

Max. Marks: **140**

SYLLABUS

I. *ELECTRON SPIN RESONANCE*

Basic principles, zero field splitting & kramer's degeneracy, factor affecting the 'g' value isotropic & anisotropic hyper fine coupling constant, spin Hamitonian, spin densities and Mc Connell relationship, measurement techniques, applications. Hyperfine coupling, spin polarization for atoms & transition metal ions, spin-orbit coupling & significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems & to inorganic free radicals such as PH_4 F_2 & BH_3.

II. *MOSSBAUER SPECTROSCOPY*

Basic principles, spectral parameters & spectrum display. Application of technique to the studies of (1) Bonding & structure of Fe^{2+} & Fe^{3+} compounds including those of intermediate spin (2) Sn^{2+} & Sn^{+4} compound-nature of M-L bond, co-ordination number, structure (3) Detection of oxidation state & inequivalent MB atoms

III. *NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY*

Quadrupole nuclei, quadrupole moments, electric field gradients, coupling constant, splitting, applications.

IV. *(A) ELECTRON DIFFRACTION*

Scattering intensity V/s scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules, low energy electron diffraction & structure of surfaces.

(B) NEUTRON DIFFERACTION

Scattering of neutrons by solid measurement techniques, elucidation of structure of magnetically ordered unit cells.

V. *SOLID STATE CHEMISTRY*

(A) Basic concept of X-ray diffraction & its application to determination of crystal structure & crystal defects. 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 lattics & X-ray intensities, structure factor & its relation to intensity & electron density, phase problem, description for an X-ray structure, absolute configuration of molecules.

(B) **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.

Books Suggested:

1. *NMR, NOR, EPR and Moassbauer Spectroscopy in Inorganic Chemistry* – R.V. Parish, Ellis Horwood
2. *Investigation of Molecular Structure, Spectroscopic and Diffraction Methods* – B.C. Gilbert Bell and Hyman Lt. London 1984
3. *Infrared and Raman Spectra: Inorganic and Coordination Compounds* – H. Nakamoto, Wiley.
4. *An Introduction to Mossbaur Spectroscopy* Ed. – L. Jyay Pletun
5. *Basic Principle of Spectroscopy*, R, Chang, Mc Graw, Hill.
6. *Solid State Chemistry & Its Application* – A.R. West. Pennum
7. *Principle of the Solid State* – H.V. Keer & Wiley Eastern
8. *Solid State Chemistry* – N.B. Hannay.
9. *Solid State Chemistry* – D.K. Chakrabarty & New Wiley Eastern.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. Final **Semester-III**

SUBJECT:CHEMISTRY **PAPER : IV**

TITLE: RESEARCH METHODOLOGY

Max. Marks: 100

SYLLABUS

1. Understanding the Research Process

Types of Research, Fundamental of Pure Research, Applied Research Action Research, Historical Research, Experimental Research, what is Scientific Research, Characteristics of Scientific Methodology, Qualities of Good Researcher, General rule of Academic Research, Types of research, Steps of Scientific Research

2. Problems of Identification and Preparatory Work

Exploratory field work & Identification the research area, narrowing on a specific topic,what is literature survey, role of literature survey and field work, formulating and delaminating a problem, Defining aims and objectives.

Computer Searches of literature

ASAP Alert, CA alerts, SciFinder, ChemPort, Science direct, STN international, Journal Home pages

3. Research Design

What is Research Design, preparing a Research Design, Steps in research design. Hypothesis testing in scientific research, sources of chemical information: primary, secondary & tertiary sources, indexes and abstracts in science and technology, chemical abstract, chemical titles, citation index.

4. Methodology, Method Tools and Techniques

Method of research:Survey research, case studies, qualitative and quantitative method, Ethnographic method.
Tools &Techniques: Observations, analytical instrumentation techniques.

5. Data Processing& Analysis Interpretation

Data processing, classification & categorization of data, data analysis, statistical method and statistical tools. data interpretation using computer and technology for research (chemical software).

6. **Report Writing**

Research ethics, avoiding plagiarism, quotations short medium and long, internet citation, foot note, writing a research paper, publication, instruction spacing, numbering heading margin, ibid etc. How to prepare ppt presentation and presentation technique.

References Books :

1. Research methodology by Kothari.
2. Joseph,A. methodology for research: theological publication: banglore,1986
3. Gibaldi,J.Achtert,W.S Handbook for writers of research papers: 2nd ed :wiley Eastern,1987.
4. H.M.Kanare,writing the laboratory notebook:American chemical society:Washington DC,1985

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS) PART-I **Semester-I**

SUBJECT: CHEMISTRY **PAPER: HONOURS-I**

TITLE: Analytical Chemistry

Max. Marks: 100

SYLLABUS

1) ***Statistical treatment of analytical data:***

(a) Types of Errors-True, standard & observed value, absolute and relative errors, mean and relative mean deviation. Physical significance of standard deviation, confidence limits and probability, Accuracy and precision. Significant figures, Rejection of observation- Q test, confidence interval test of significance-t test, chi-square test and F test.

(b) Sampling and sample handling- Concept of sampling, Representative sample, storage, pre-treatment and its preparation.

2) ***Methods of analysis:***

(a) Qualitative analysis:- Basic concept of Inorganic analysis- Common ion effect, solubility product, ionic product, effect of pH and buffer in inorganic analysis.

(b) Quantitative analysis

(i) Volumetric analysis – Basic concept and its types, theories of indicator, Law of equivalence, standards and its type.

(ii) Gravimetric analysis- Basic concept

(c) Instrumental method of analysis

(i) Conductivity- TDS meter- Principle, selection of standard solutions, calibration

(ii) pH meter-Principle, selection of standards, calibration

(iii)Potentiometer- Principle, selection of standards, calibration

3) ***Photometric Method of Analysis:***

(a) Electromagnetic radiation, properties of electromagnetic radiation, electromagnetic spectrum, types of spectrum. Spectroscopy-atomic and molecular (rotational, vibrational and electronic spectra).

(b) Spectrometer/Colorimeter- Lambert-Beer's law, Instrumentation and applications.

4) ***Separation Method:***

(a) Solvent Extraction - Introduction, principle - Distribution Law, extraction technique and its types, completeness and selectivity of extraction , factors affecting solvent extraction and analytical applications.

(b) Chromatography -

(i) General principles, classification and applications.

(ii) A brief description of – Paper, TLC, Column chromatography.

(c) Ion-exchange method - Ion exchangers, properties and its applications.

5) ***Adsorption:***

(a) Introduction, mechanism and its types. Adsorption of gases by solids, adsorption isotherms - Freundlich and Langmuir. Adsorption of solutes from solutions, applications.

(b) Micelles- Surface active agents, critical micelle concentration (CMC), factors affecting the CMC of surfactant.

References:

1. Singh Mahinder, *Analytical Chemistry*, Dominant Publication.
2. Chatwal G.R, *Analytical Chromatography*, Himalaya Publication.
3. Khandpur R.S, *Handbook of Analytical Instruments*, Tata McGraw Publication.
4. Verma R.M, *Analytical Chemistry*, CBS Publication.
5. Gupta Alka, *Analytical chemistry*, Pragati Prakashan.
6. Sharma B.K, *Analytical Chemistry*, Krishna Prakashan.
7. Anjaneyulu T.B, *Analytical Chemistry,* Pharma Book Publication.

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): PART-I Semester: **I**

SUBJECT: **CHEMISTRY** PAPER: **HONOURS-II / SUBSIDIARY**

TITLE: Inorganic Chemistry – I

Max. Marks: **100**

SYLLABUS

1. ***Atomic Structure & Elementary Quantum Mechanics:***

   (A) Quantum Numbers Shapes of *s, p, d, f* orbitals. Aufbau principle and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements, effective nuclear charge. Dual nature of Electron, Photo Electric Effect, Compton effect, Idea of the de-Broglie matter waves, Heisenberg Uncertainty principle, Bohr's Model of Hydrogen atom (no derivation) and its defects.

   (B) Molecular orbital theory, basic ideas – criteria for forming M.O, construction M.O's by LCAO-H_2^+ ion calculation of energy levels from wave functions, concept of σ, σ^*, π, π^* & n orbitals and their characteristics. Hybrid orbitals – (sp, sp^2, sp^3), calculation of co-efficient of A.O.'s used in these hybrid orbitals. Schrödinger wave equation, Significance of ψ and ψ^2.

2. ***Periodic Properties:***

   Atomic and ionic radii, ionization energy, electron affinity and electro negativity definition, methods of determination, trends in periodic table and applications in predicting and explaining the chemical behaviour.

3. ***Chemical Bonding***:

   (A) **Covalent Bond** – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to NH_3, H_3O^+, SF_4, $C\ell F_3$, $IC\ell_2$ and H_2O. MO theory, homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electro negativity difference.

   (i) **Ionic Solids** – Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, Semiconductors, Lattice energy and Born-Haber cycle, Solvation energy and Solubility of Ionic solids, polarizing power and polarisability of ions, Fajan's rule. Metallic bond: free electron, valence bond and bond theories.

   (ii) **Weak Interactions** – Hydrogen bonding, Vander Waals forces.

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4. ***Oxidation and Reduction:***

   Use of Redox Potential Data – Analysis of Redox Cycle, Redox Stability in Water, Frost, Latimer and Pourbiax diagram, Principle involved in extraction of two elements.

5. ***S – Block Elements:***

   Comparative Study, Diagonal Relationships, Salient Feature of Hydrides, Solvation and Complexation Tendencies including their functions in bio-system, biological role of s-block elements.

6. ***P- Block Elements:***

   Comparative Study (Including Diagonal Relationship) of group 13 to 17 elements, Compounds like Hydrides, Oxides, Oxyacids and Halides of group 13 to 16, Hydrides of Boron, Diboranes and Higher Boranes, Borazines, Fullarenes, Carbides, Fluorocarbons, Silicates (structural principle), Silicones and Phosphazenes, Tetrasulphur Tetranitrides, Basic Properties of Halogens, Interhalogens and Polyhalides. Biological role of p-block elements.

7. ***Chemistry of Noble Gases:***

   Chemical Properties of Noble Gases, Chemistry of Xenon, Structure and Bonding of Xenon Compounds.

8. ***Acid and Bases:***

   Arrhenius, Bronsted and Lowry, Lux-Flood Solvent System and Lewis Concept of Acid and Bases, Pearson's Classification of Acid and Bases as Hard and Soft, Acid-Base strength and Hardness and Softness, Symbiosis, Theoretical bases of Hardness and Softness, Electronegativity and Hardness and Softness.

References:

1. Gurdeep Raj, *Inorganic Chemistry*, Krishna Publications.
2. Malik Wahid, *Inorganic Chemistry*, S. Chand Publications.
3. Lee J.D, *Concise Inorganic Chemis*try, Blackwell Publications.
4. Madan R.D, *Modern Inorganic Chemistry*, S. Chand Publications.
5. Satya Prakash, *Advanced Inorganic Chemistry*, S. Chand Publication.
6. Huheey James, *Inorganic Chemistry*, Addison Wesley publication.

25.4.18

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): PART-I **Semester: II**

SUBJECT: CHEMISTRY **PAPER-HONOURS -I**

TITLE:Environmental Chemistry

Maximum Marks: **100**

SYLLABUS

1. **Atmospheric Chemistry**:
   (a) Evolution of Atmosphere, Major region of Atmosphere, composition of Atmosphere , Temperature inversion, Meteorology and Human activities, Surface temperature of Earth, Earth's Heat balances.
   (b) Photochemistry: Primary photochemical process, Radicals in Atmosphere ($OH^{\cdot}$) and ($HO_2^{\cdot}$). Ions in mesosphere and lower Thermosphere, Reactions of atmospheric Nitrogen, O_2, CO_2 and H_2O.

2. **Air Pollution**:
   Classification and control of air pollutants:
   Inorganic air pollutants: Oxides of C, N, S, Ozone, Carbonyl Sulphidesand Carbon disulphide. Fluorine and its compounds
   Organic Air pollutants: Hydrocarbons, Alkyl Aryl halides, Aldehyde and Ketones. Acid Rain, photochemical Smog, Depletion of ozone layer, Green House Effect and its consequences

3. **Water Pollution**:
   Classification of water pollutants:
   Hardness and Alkalinity, DO, BOD and COD
   Control of water pollution: Water softening , Advanced Techniques of Water treatment :Using liquid-liquid separation, liquid-solid separation, use of coagulants and High intensity aeration process. Removal of Metallic ions, Waste water treatment methods: Nitrogen removal, phosphorus removal, sludge treatment. Sewage treatment: Primary, secondary,tertiary. Water Reuse and Recycle

4. **Soil Pollution:**
   Soil type, Trace metals, Organic matter in soil and micro nutrients in soil, pollution of soil, Agricultural pollution

5. **Biochemical Effect of Toxic Metals on Man:**
   Enzymes inhibited by Toxic metals, Effect of Mercury, Lead, Arsenic, Cadmium and Cobalt.

6. **Thermal Pollution**: Sources and Effect of Thermal pollution and its control.

7. **Noise Pollution**: Sources and Effect of Noise pollution and its control.
8. **Radioactive Pollution**: Types of radiations, Radioactive Decay process, Decay law, Radiation detectors, Harmful effect of radiation, Radiation safety standards, Waste disposal problem, Nuclear reactor Accidents.
9. **Basic Principles of Green Chemistry**: Prevention of waste or By-products, Maximum incorporation of the reactant into the final product, Minimization of hazardous products, Designing safer chemicals, Energy requirements for synthesis, Selection of appropriate solvent, Selection of starting materials, Use of protecting Groups, Use of Catalyst, Product Designed should be biodegradable, Designing of manufacturing plants, Strengthening of analytical techniques.

Reference Books:

1. Chatwal,G.R., *Environmental Studies*, Himalaya Publication
2. Sharma, B.K., *Environment Chemistry*, Krishna Prakashan
3. Dara, S.S, *Environment Chemistry and Pollution Control*, S.Chand Publication
4. Sawyer, Clair, *Chemistry for Environmental Engineering*, Tata McGrawPublication
5. Mishra, D.D., *Environmental Chemistry*, S.Chand Publication
6. Banerjee, Samir, *Environmental Chemistry*, P.H.I.Publication
7. Jadhav, H.V., *Environmental Pollution*, Himalaya Publication
8. Sindhu, P.S., *Environmental Chemistry*, New Age Publication

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): **PART-I** Semester: **II**

SUBJECT: CHEMISTRY **PAPER: HONOURS II/SUBSIDIARY**

TITLE:Organic Chemistry-I

Maximum Marks: **100**

SYLLABUS

1. Structure and Bonding:

Characteristics of carbon, concept of hybridization(SP^3,SP^2,SP) and their molecular shapes,Vander Waals interactions, Inclusion compounds,Charge transfer complexes, polar effects, hyper conjugation, Resonance, Hydrogen bonding, its types and effect on physical properties .

2. Mechanism of Organic Reactions:

Bond cleavage, types of reagents, types of organic reactions, energy considerations, thermodynamic and kinetic control. Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereo chemical studies.)

Reactive intermediates-

Carbonium ions,Carbanoins,Free radicals, Carbenes, Arynes, and Nitrinestheir structure and stability.

3. Stereochemistry of Organic Compounds:

Concept of Isomerism, types of isomerism.

Optical Isomerism – Elements of Symmetry, Molecular Chirality, Enantiomers, StereogenicCentres, Diastereomers, Threo and Erythro stereoisomers, meso Compounds, Resolution of Enantiomers, Inversion, Retention and Racemization. Relative and Absolute Configuration, Sequence Rules, D- and L- and R-and S- Systems of Nomenclature.

Geometrical Isomerism – Determination of Configuration of Geometrical Isomers. E and Z System of Nomenclature, Geometrical Isomerism in Oximes and Alicyclic Compounds.

Conformational Isomerism –Conformational Analysis of Ethane and n-butane, Conformation of Cyclohexane, Axial and Equatorial Bonds, Conformation of Mono-substituted Cyclohexane Derivatives. Newman Projection and Sawhorse Difference between configuration and conformation.

4. Alkanes and Cycloalkanes:

IUPAC Nomenclature and Isomerism of Alkanes,Physical properties and chemical properties of alkanes, Mechanism of free radical halogenation of methane,energy consideration, orientation , reactivity and selectivity.

Cycloalkanes- Nomenclature and isomerism, methods of formation, chemical reactions, stability of Cycloalkanes, Baeyer's strain theory and its limitations,theory of strainless rings,conformation of cyclohexane.

5. Alkenes and Cycloalkenes:

Nomenclature and Isomerismof alkenes&cycloalkenes, methods of formation,physical properties and relative stabilities. Chemical reactions - mechanisms involved in hydrogenation, electrophilic addition and Markownikoff's rule, free radical and Antimarkownikoff's rule,hydroboration – oxidation,oxymercuration-reduction. Epoxidation, ozonylysis, hydration, hydroxylation and oxidation with $KMnO_4$, OsO_4. Polymerization of alkenes by cation,anion and free radical mechanisms. Substitution at the allylic and vinylic positions of alkenes.

Dienes and Alkynes:Nomenclature,classification, properties and structure of dienes. Butadiene, stability and properties, addition, polymerization, Diel'sAlder reaction.

Nomenclature, structure, bonding and acidity in alkynes, methods of formation & their chemical reactions.Mechanism of electrophillic and nucliphillic addition reactions,oxidation,reduction and polymerization.

6. Arenes and Aromaticity:

Nomenclature of benzenederivatives. Thearyl-group. Aromatic nucleus and side chain,

Structure of benzene-Molecular formula Evidences in favor of Kekule structure, stability and Carbon-Carbon bond length in benzene, resonance structure and Molecular Orbital structure, resonance energy.

Aromaticity-Huckel's rule, Aromatic sextet, Aromatic behavior of non-benzenoid compounds.

Aromatic electrophillic substitution- general pattern of the mechanism, role of σ and π complexes, mechanism of nitration, halogenations, sulphonation,Friedel-craft reaction. Energy profile diagrams. Activating and deactivating groups, Directing Influence of substituents, Orientation and ortho/para ratio.

Methods of formation and chemical reactions of alkyl benzenes and biphenyl

7. Alkyl and Aryl halides:

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions, mechanism of nucleophilic substitution reactions of alkyl halides, SN^2 and SN^1mechanism with energy profile diagrams, Saytzeff and Hofmann elimination.

Polyhalogen compounds- chloroform, carbon tetra chloride methods formation and chemical properties.

Aryl halides-Methods of formation,chemical properties- nuclear and side chain reactions, the addition –elimination and the elimination-addition mechanism of substitution reactions.

Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

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8. Alcohols

Classification and nomenclature

Monohydric alcohols-Methods of formation effect of hydrogen bonding on physical properties, acidic nature and chemical properties.

Dihydric alcohols-Methods of formation,chemical reactions of glycols,oxidative cleavage, pinacol-pinacolone rearrangement.

Trihydric alcohols- glycerol- synthesis, physical and chemical properties.

9. Phenols

Nomenclature, preparation of phenols,physical properties and acidic character. Comparison of acidic strengths of alcohols andphenols. Electrophilic substitution and other properties with mechanism.

10. Aldehyde and Ketones

Nomenclature, structure and reactivity of carbonyl group,synthesis of aldehyde and Ketone, physical and chemical properties, mechanism of nucleophillic addition to carbonyl group with particular emphasis on benzoin,aldol, Perkin and Knoevenagel condensation.Application of acetals as protecting group of carbonyl group. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction. Cannizzaro-reaction. Halogenaton and enolisation of aldehyde and ketones. Reductions-Meerwein-PonndorfVerley (MPV) reduction, Clemensen's, Wolf Kishner reductions, reductions with metal hydride ($LiAlH_4$ and $NaBH_4$). Oxidation of aldehydes, Baeyer-villager oxidation of ketones.

References :

1. Finar, I. L.,*Organic Chemistry,Vol-I,edition 6th* ,B S/E L with Longman publication
2. Mukherji, S.M.,*Reaction Mechanism in Organic Chemistry*,Macmillan Publication
3. Morrison, R.T.,*Organic Chemistry*,Prentice Hall Publication
4. Jerry March,*Advanced Organic Chemistry,* WeleyPublication
5. Robert Thornton,*Organic Chemistry*,Pearson Publication
6. Sykes Peter,*A Guidebook to Mechanismin Organic Chemistry*, Pearson Publication
7. Madan,R.L.,*Organic Reaction Conversion*, S.Chand Publication

MP-44. 25.4.18

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): PART-II **Semester: III**

SUBJECT: CHEMISTRY **PAPER: HONOURS-I**

TITLE: Natural Products

Max. Marks: 100

SYLLABUS

I. ***Alkaloids:***
Definition, classification, occurrence, extraction (outline), general properties, structure determination, degradation methods.
Structure of - Coniine, Nicotine, Piperine.

II. ***Terpenes:***
Introduction, occurence, classification, Isoprene rule, isolation, general, properties, general structure determination.
Structure of - Citral, Limonene, α-terpineol.

III. ***Vitamins:***
Introduction, discovery, classification, nomenclature, metabolic, physiological functions.
Structure of vitamin-A and vitamin-C.

IV. ***Pyrimidines:***
Introduction; General characters and structures. Ureides, Cyclic Ureides, Barbituric acid.

V. ***Purines:***
Introduction, classification, occurrence, isolation, properties, structure and synthesis of uric acid, caffeine.

VI. ***Polynuclear Aromatic Hydrocarbons:***
Introduction, occurrence, preparation, synthesis, properties and structure of naphthalene, anthracene and phenanthracene, carcinogenic activity.

References:

1. Aggarwal O.P, *Chemistry of Organic Natural Products Vol I,* Goel Publication House, Meerut.
2. Aggarwal O.P, *Chemistry of Organic Natural Products Vol II*, Goel Publication House, Meerut.
3. Chatwal Gurdeep R., *Organic Chemistry of Natural Products Vol I*, Himalaya Publication House.
4. Chatwal Gurdeep R., *Organic Chemistry of Natural Products Vol II*, Himalaya Publication House.
5. Finar I.L, *Organic Chemistry,* Pearson Publication.
6. Soni P.L, *Organic Chemistry*

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc.(HONOURS) : **PART-II** Semester: **III**

SUBJECT: Chemistry **PAPER: Honours-II/Subsidiary**

TITLE: Physical Chemistry - I

SYLLABUS

I. Gaseous state

Postulates of Kinetic Theory of gases, deviation from ideal behaviour, Vander Waal's equation of state.

Critical Phenomena: PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation, relationship between critical constants and Vander Waal's constants, the law of corresponding states, reduced equation of state.

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

II. Liquid State

Intermolecular forces, structure of liquids (a qualitative description). Structural differences between solids, liquids and gases.

Liquid crystal: Difference between liquid crystal, solid and liquid. Classification structure of nematic and cholestric phases. Thermography and seven segment cell.

III. Solid State

Definition of space lattice, unit cell.

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

X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCℓ, KCℓ and CsCℓ (Laue's Method and Powder Method)

IV. Colloidal State

Definition of colloids, classification of colloids.

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Solid in liquids (sols): Kinetic, optical and electrical, properties, stability of colloids, protective action, Hardy-Schuzle Law, gold number.

Liquids in liquids (emulsions): Types of emulsions, preparation and properties, inhibition, general applications of colloids.

V. Phase Equilibrium

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

Phase equilibria of two component system – Solid-liquid equilibria, simple eutectic Bi-Cd, Pb-Ag systems, desilverisation of lead.

Solid solutions – compound formulation with congruent melting point (Mg-Zn) and incongruent melting point, ($NaC\ell$-H_2O), ($FeC\ell_3$-H_2O) and ($CuSO_4$ H_2O) system. Freezing mixtures, acetone - dry ice.

Liquid-liquid mixtures: Ideal liquid mixtures, Raoults and Henry's Law. Non ideal system – azeotropes - $HC\ell$-H_2O and ethanol-water systems.

Partially miscible liquids: Phenol-water, trimethylamine-water, nicotine-water system. Lower and upper consolute temperature. Effect of impurity on consulate temperature. Nernst distribution Law - Thermodynamic derivation, applications.

VI. Thermodynamics-I

Definition of thermodynamic terms: Systems, surroundings, *etc.* Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's Law - Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

VII. Thermo Chemistry

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. Bond dissociation energy and its calculations from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation. Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's Principle.

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VIII. Thermodynamics-II

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

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

Statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P, V and T.
Reaction isotherm and reaction isochore. Clapeyron equation and Clausius–Clapeyron equation, application
Third Law of Thermodynamics: Nernst heat theorem

References:

1. Singh N.B, *Physical Chemistry*, Dominant Publication.
2. Laidler Keith J, *Chemical Kinetics*, Pearson Education publication.
3. Berry R.Stephan, *Physical Chemistry*, Oxford press publication.
4. Yadav J.B, *Physical Chemistry*, Goel publication.
5. Raj Gurdeep, *Advanced Physical Chemistry*, Krishna Prakashan.
6. Laidler J. Keith, *Physical Chemistry*, CBS Publication
7. Castellan Gilbert W, *Physical Chemistry*, Narosa publication

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc.(HONOURS): **PART-II** Semester: **IV**

SUBJECT: CHEMISTRY **PAPER: HONOURS - I**

TITLE: Mathematical & Computer Applications in Chemistry

Maximum Marks: **100** *(50 marks for each section A and B)*

SYLLABUS

Section-A: Syllabus for mathematical application in Chemistry

Trigonometry

Trigonometric functions, Graphical presentation of Trigonometric function for sinθ cosθ & tanθ.

Algebra

1. *Set theory:* Set, subset, power set,
   Operation on sets: Union, Intersection, Disjoint, Differences and compliments of sets, Algebra of sets (laws of sets).
2. *Euler Venn Diagrams:* Relations, Domain and Range of a relation, various type of relations.
3. *Complex Numbers:* Imaginary numbers, Complex numbers, Properties of complex numbers.
4. *Sequences & Series:* Arithmetic Progression, Geometric Progression, Exponential series, Logarithm series.
5. *Binomial Theorem:* Theorem and its simple applications.
6. *Quadratic Equations:* Roots of an equation, Number of roots, Equation reducible to quadratic equations, Symmetric function.

Determinants and Matrices

1. *Determinants* of order two and three, Minors, Cofactors, Expansion of determinants, Properties of determinants, Value of a determinant.
2. *Matrix:* Definition, Operations on matrices, Addition, Subtraction and multiplication of matrices, Linear combination of matrices, Solution of linear equations.

Three Dimensional Geometry

Coordinate axes, Distance between two points, Cartesian Coordinates, Angle between two lines.

Vector Algebra

Definitions, Addition of vectors, Difference of vectors, Multiplication of vectors – dot product and vector products. Orthogonal systems of unit vectors.

Function, Limits & Continuity

Function, constant, Variable, Domain of variable, Binary operations, Graph of a real function, Limits, evaluation of limits, Some important limits (important limit value only) meaning of the symbol $\lim_{x\to\infty} f(x) = l$. Properties of continuous functions.

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Differentiation (Differential calculus)

Meaning, Differentiation of standard form, Differential of sum, Difference, Product and quotient, Differential coefficient of a function of functions. Second derivatives.

Integral Calculus

Infinite integration by substitution (simple cases), Definite integrals.

Differential Equations

Linear equation, Formation of differential equation, Solution of a differential equation (without variable).

Section-B: Syllabus for Computer Application

In computer application, the students have to learn 'C' language and its application in Chemistry. The topics of chemistry should be within the syllabus of chemistry as prescribed by UGC for B.Sc. classes.

'C' Language will cover the following topics:

1. ***Programming Language:*** Brief description of machine language and assembly languages. Language translators, Algorithm and flow charts. An over view of '**C**' programming
2. ***Data Type, Constants & Variable:*** Character set, '**C**' tokens, Keywords and Identifiers, Constant & variable, Data type, Declaration of variable, assigning values to variables, symbolic constants.
3. ***Operators & Expressions:*** Arithmetic, Relational, Logical, Assignment, Increment and decrement, Conditional, Bit wise & special Operators. Arithmetic expressions, Evaluation of expression, Precedence of arithmetic operators, Mathematical functions.
4. ***Input/Output Operations:*** Reading & writing character, Formatted input and output.
5. ***Control Statements:*** **If**, **If .... Else**, Nesting of **If** ... **Else** statement, The **Else** ... **If** ladder, The **switch** statement, the **?:** operator and **GOTO** statement.
6. ***Looping:*** **While**, **Do-While**, **for** loops, Jumps in loops the **break**, **Continue** and **Exit** statement.
7. ***Arrays:*** One dimensional & Two dimensional arrays.
8. ***Character Strings:*** Declaring & initializing string variables, Reading & writing of strings.
9. ***User Defined Functions:*** The form of '**C**' functions, Return values and their types, calling a function, categories of functions: (i) No argument – no return value (ii) Argument but no return values (iii) Argument with return values. Function with Arrays, The scope and lifetime of variables in function (Local and global variables).
10. ***File Management:*** Opening, Reading and closing a file in '**C**' Input /Output operation on files.

Reference Books:

1. Singh, Bhupendra, *Mathematics for Chemist*, Pragati Prakashan
2. Kumari Ramesh, *Computers and their Application to Chemistry*, Narosa Publication
3. Aggarwal, Naresh, *Computer in Chemistry*, Sonali Publication
4. Rao, Sambasiva R., *Computer Application in Chemistry*, Himalaya Publication
5. Sigh, S.K., *Mathematics and Computer for Chemist*, S. Chand Publication
6. E. Balagurusami, *ANSI C*, S. Chand Publication
7. Yashvant Kanitkar, *Let Us 'C'*, BPB Publication

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Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): **PART-II** Semester: **IV**

SUBJECT: **CHEMISTRY** Paper: **HONOURS II**

TITLE: **Inorganic Chemistry-II**

Maximum Marks: **100**

SYLLABUS

1. **Chemistry of First Transition Series:**

   Characteristic Properties of d-Block Elements, Properties of Elements of First Transition Series, their Binary Compounds and Complexes illustrating Relative Stability of their Oxidation States, Coordination Number and Geometry.

2. **Chemistry of Second and Third Transition Series:**

   General Characteristics, Comparative Treatment with their 3d analogues in respect of – Ionic Radii, Oxidation States, Magnetic behavior and Spectral Properties and Sterio-chemistry.

3. **Coordination Compounds:**

   Werner's Coordination Theory and its Experimental Verification, Effective Atomic Number Concept, Chelates, Nomenclature of Coordination Compounds, Isomerism in Coordination Compounds, VBT of Transition Metal Complexes. Biological Role of Coordination Compounds-Haemoglobin and Myoglobin.

4. **Metal Ligand Bonding in Transition Metal Complexes:**

   Limitation of VBT and Elementary idea of CFT, Crystal Field Splitting in Octahedral, Tetrahedral and Square Planar Complexes, Factors Affecting Crystal Field Parameters.

5. **Magnetic Properties of Transition Metal Complexes:**

   Types of Magnetic Behaviour, Methods of Determining magnetic Susceptibility, Spin only Formula, L-S Coupling, Correlation of μ_s and μ_{exp} values, Orbital Contribution to Magnetic Moments, Application of Magnetic Moment Data for 3d Metal Complexes.

6. **Electronic Spectra of Transition Metal Complexes:**

   Types of Electronic Transitions, Selection Rules for d-d transition, Spectroscopic Ground States, Spectro-chemical Series. Orgel Energy Level Diagram for d^1 to d^9 states, Discussion of Electronic Spectrum of $[Ti(H_2O)_6]^{3+}$ Complex Ion.

7. Thermodynamics and Kinetic Aspects of Metal Complexes:

A Brief Outline of Thermodynamic Stability of Metal Complexes and Factors affecting stability, Substitution Reaction of Square Planar Complexes.

8. Chemistry of Lanthanide Elements:

Electronic Structure, Oxidation State and Ionic Radii and Lanthanide contraction. Complex Formation, Occurrence and Isolation of Lanthanides.

9. Chemistry of Actinides:

General Features and Chemistry of Actinides, Chemistry of Separation of Np, Pu, Am from U, Similarities between later Actinides and later Lanthanides.

10. Organometallic Chemistry:

A Brief Account of Metal-ethylene Complexes and Homogeneous Hydrogenation, Mononuclear Carbonyls and Nature of Bonding in Metal Carbonyls.

Reference Books:

1. Gurdeep Raj, *Inorganic Chemistry*, Krishna Publication
2. Malik Waheed, *Inorganic Chemistry*, S. Chand Publication
3. Madan R.D., *Modern Inorganic Chemistry*, S. Chand Publication
4. Satya Prakash, *Advanced Inorganic Chemistry*, S. Chand Publication
5. Lee J.D., *Concise Inorganic Chemistry*, Blackwell Publication
6. Huheey James, *Inorganic Chemistry*, Addison Wesely Publication
7. Cotton & Wilkenson, *Advanced Inorganic Chemistry*, Wiley John Publication
8. Malik Waheed, *Selected Topic in Inorganic Chemistry*, S. Chand Publication.

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Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): PART-III **Semester: V**

SUBJECT: CHEMISTRY **PAPER: HONOURS-I**

TITLE: Industrial Chemistry

Max. Marks: **100**

SYLLABUS

1. ***Metallurgy:***

   Introduction, Characteristics and Physical properties of metals, Slags and Fluxes, Classifications of ores, Furnaces and dressing of ores.

   Metallurgy of Cast Iron from Haematite ore, Copper from Copper Pyrite and Aluminium from Bauxite.

   Alloys:

   Introduction, Purpose of Alloying, Types of Alloys, Ferrous Alloys – Steel (Properties and Heat treatment of Steel), Non Ferrous Alloys – Composition, Characteristics and uses of the alloys of copper and aluminum.

2. ***Sugar Industry:***

   Introduction, manufacture of cane sugar, extraction and purification of juice, defection, sulphitation and carbonation, concentration or evaporation, crystallization recovery of sugar from molasses, Manufacture of sucrose from beet root and testing of sugar.

3. ***Fats, Oils and detergents:***

   Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, halogenation of unsaturated oils, saponification value, iodine value, acid value, soaps and synthetic detergents.

4. ***Paper and Pulp Technology:***

   Introduction, Types of pulping, manufacturing of pulp, sulphate or kraft pulp, soda pulp, sulphite pulp, rag pulp, beating, refining, filling, sizing and coloring. Peroxide bleaching and its chemistry, Importance of bleaching. Manufacture of paper, calendaring and uses. Paper industry in India.

5. ***Cement Technology:***

   Classification of cements (Hydraulic and Non-hydraulic), Portland cement production: (1) Quarrying and Crushing (2) Raw material handling and Storage (3) Raw material blending & homogenization (4) Clinker production, cooling and grinding. Hydration chemistry of Portland cement, Setting of cement & factors affecting it.

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6. ***Lubricants:***

Introduction, Mechanism of Lubrication, Classification of Lubricants – Solid, Liquid, Semi-Solid Lubricants: Grease, Properties of Lubricating Oils and Greases, Synthetic Lubricants, Lubricating Emulsions, Cutting Fluids

7. ***Fuels:***

Introduction and Classification of Fuels, Characteristics of a good Fuel

Calorific Value: Definition, Units, Gross and Net Calorific Value, Determination of Calorific Value – Bomb Calorimeter [Construction, Working and Calculations (use of Dulong's Formula)].

Coal: Origin, Classification of Coal by Rank, Selection of Coal, Analysis of Coal – Proximate and Ultimate Analysis, Carbonization of Coal, Pulverized Coal, Metallurgical Coke – Requisites of Metallurgical Coke and Manufacture of Metallurgical Coke.

Petroleum: Origin, Classification, Cracking – Thermal and Catalytic Cracking, Synthesis of Synthetic Petrol – By Polymerization and By Fischer-Tropes Method, Refining of Gasoline, Reforming and Knocking.

Gaseous Fuels : Classification, water gas, producer gas, LPG and CNG.

Non-Conventional Sources of Energy: Biomass and Biogas.

References:

1. J. A. Kent: Riegel's, *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
2. S. C. Bhatia: *Chemical Process Industries,* Vol. I & II, CBS Publishers, New Delhi.
3. P. C. Jain, M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
5. B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut.
6. E. Stocchi: *Industrial Chemistry,* Vol -I, Ellis Horwood Ltd. UK.
7. B. K. Sharma: *Industrial Chemistry*, Goel Publishing House, Meerut.

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Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): **PART-III** Semester: **V**

SUBJECT: **CHEMISTRY** PAPER: **HONOURS-II / SUBSIDIARY**

TITLE: Organic Chemistry

Max. Marks: 100

SYLLABUS

1. **Organic Polymer:**
   Definition, natural polymer, plastic elastomers, fibers homopolymers, co-polymers, Thermoplastic, Thermoset, Recycled plastics, PET, HDPE, PVC, GDPE, PS.

2. **Carboxylic Acid:**

   Monocarboxylic Acid: Nomenclature, Structure and acidic nature, comparison of carbonyl group's nature in carboxylic acids, aldehydes and ketones. Preparation and Properties of Fatty acids.

   Dicarboxylic Acid: Preparation and Properties of – Oxalic acid, Malonic acid and Succinic acid.

3 **Carboxylic Acid Derivatives:**
   Nomenclature, Preparation and Properties of Acid Chlorides, Amides, Acid Anhydrides and Esters, Mechanism of Esterification.

4 **Organic Synthesis via Enolates:**
   Acidity of α-hydrogens, alkylation of malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the claisen condensation, keto-enol tautomerism of ethyl acetoacetate.
   Alkylation of 1,3 dithianes ,alkylation acylation of enamines

5 **Organ metallic compounds:** Organomagnesium compounds; Grignard reagents-Formation, structure and chemical reactions
   Organozinc compounds: Formation and chemical reactions.
   Organolithium compounds: Formation and chemical reactions.

6 **Organosulphur compounds:**
   Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

7 Organic Compounds of Nitrogen:

Nitroalkanes and Nitroarenes: Preparation and Chemical properties. Mechanism of nucleophilic substitution in Nitroarenes and their reduction in acidic, neutral and alkaline media.

Amines: Aliphatic and Aromatic amines- their nomenclature, preparation and properties. Separation of primary, secondary and tertiary aliphatic amines Structural features affecting the basicity in aliphatic and aromatic amines. Electrophillic aromatic substitution in aryl amines.

Diazonium Salts: Preparation and Properties.

8 Heterocyclic Compounds:

Aromatic behaviour of 5 and 6 membered heterocyclics. preparations and chemical properties of Pyrrole, Furan, Thiophene and Pyridine, mechanism of electrophilic substitution and their reactivity at α and β carbon atoms. Mechanism of nucleophilic substitution reactions in Pyridine. Comparison of basicity of Pyridine, Piperidine and Pyrrole.

Preparation and properties of Indole, Quinoline and Isoquinoline. mechanism of substitution reactions.

9 Carbohydrates:

Classification of Carbohydrates, Monosaccharides: Nomenclature properties of aldoses and ketoses. Interconversion of glucose, mannose and fructose, chain lengthening and chain shortening. Configuration of monosaccharides. Erythro and Threo diastereomers. Formation of glycosides, ethers and esters. Structure of D (+) Glucose , D(-) Fructose, (open and cyclic), determination of ring size. Mechanism of Mutarotation.

An introduction to Disaccharides (Maltose, Sucrose and Lactose) their conformation and properties, Polysaccharides (Starch and Cellulose) Properties.

10 Amino Acids, Peptides, Proteins and Nucleic Acids:

Amino Acids: Classification, structure and stereochemistry of Amino acids. Acid-base behaviour, Isoelectric point and Electrophoresis. Preparation and properties of α Amino acids.

Peptides: synthesis, properties and structure. Sequence determination of amino acid by end group analysis.

Proteins: Classification, nomenclature, properties and tests. Denaturation and Renaturation. Levels of protein structure.

11 Electromagnetic Spectrum : Absorption Spectrum:

Ultraviolet Spectroscopy: Beer Lambert's Law, Molar Absorptivity, Types of electronic transition, Effect of conjugation. Concept of Auxochrome and Chromophore, Bathochromic, Hypsochromic, Hyperchromic and Hypochromic Shift. Colour and constitution. UV spectra of conjugated Enes and Enones. Analysis of UV Spectra.

InfraRed Spectroscopy: Molecular vibration, Hook's law, Selection rules, Intensity and position of IR bands, measurement of IR spectra, Fingerprint region, characteristic absorption of various functional groups. Interpretation of IR spectra of simple organic compounds.

12 Nuclear Magnetic Resonance Spectroscopy:

Introduction, shielding and deshielding, Chemical shift and Molecular structure, spin-spin splitting and coupling constants, Axes of signals, Interpretation of PMR Spectra of Simple Organic molecules like ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, Toulene and acetophenone. Problem pertaining to structure elucidation of Simple Organic compounds using UV, IR and PMR Spectroscopic techniques.

References:

1. March Jerry, *Advanced Organic Chemistry*, Weley Publication.
2. Kalsi P.S, *Spectroscopy of Organic Compound*, New Age Publication.
3. Sharma Y.R, *Elementary Organic Chemistry*, S. Chand Publication.
4. Ernest L. Elie's, *Stereochemistry of Organic Compound*, Weley Publication.
5. Finar I.L, *Organic Chemistry*, Pearson Publication.
6. Sharma B.k, *Spectroscopy,* Krishna Prakashan.
7. Bhatnagar M.S, *Polymer Chemistry*, S. Chand Publication.

Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (HONOURS): **PART-III** Semester: **VI**

SUBJECT: **CHEMISTRY** PAPER: **HONOURS-I**

TITLE: **Biochemistry**

Maximum Marks: **100**

SYLLABUS

1. Introduction to Biochemistry &, Bio-Physical Chemistry:

(a) water metabolism-Dehydration & its types, Biochemical Functions of Inorganic Ions: Role of Ca^{2+}, K^{+}, Na^{+}, Mg^{2+}, Fe^{2+} in living system & their requirements Fe storage & transport proteins-Ferritin, transferring & hemosiderin, Oxygen transport, Protein, Fe-S proteins.

(b) **pH scale, buffer** - General introduction of Acid & Base. Buffer-Definition, composition, Henderson equation, Role of different biological buffer system like-Phosphate buffer, Bicarbonate buffer, Protein /Amino acid buffer, Haemoglobin buffer system.

2. (a) **Biological oxidation** - Definition, Types of biological oxidation Reduction oxidation by direct action of oxygen, oxidation by loss of hydrogen.

(b) Mitochondrial electron transport chain, inhibitors of ETC.

(c) **Oxidative phosphorylation** - Definition, Theories, Inhibitors of Oxidative-phosphorylation, Un-couplers.

3. (a) **Bioenergetics** - Coupled reaction, law of thermodynamics, Free energy, Relationship between Standard Free energy change & Equilibrium constant. General introduction of high energy compounds.

(b) **Introduction to ATP** - Structure, ATP as universal currency of free energy in biological systems with example-in muscle contraction, Free energy of ATP Hydrolysis.

4. Nucleic Acid & Enzymes:

(a) **Nucleic Acid** – Introduction, constituents (sugars and bases), nucleosides and nucleotides. Double helical structure of DNA.

(b) **Enzyme** - Definition, Classification, Nomenclature, Coenzyme, Cofactors, Properties of enzyme, factors affecting enzyme activity, Active site, Mechanism of enzyme action-Lock & Key theory, Koshland theory, strain theory. Enzyme Kinetics – Michaelis-Menton equation, L.B Plot. Medical importance of enzyme.

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5. Metabolism / Clinical Application:

(a) **Carbohydrate** - Glycolysis, TCA, Glycogenesis, Glycogenolysis, HMP shunt, Gluconeogenesis.

Bioenergetics, clinical application. Inborn error of carbohydrate metabolism.

(b) **Lipid** – β **Oxidation** of Fatty acid, TG Hydrolysis, Ketone bodies metabolism, Bioenergetics, clinical application. Inborn error of lipid metabolism.

(c) **Amino-acid/Protein** - Transamination, Decarboxylation, Deamination, Fate of ammonium, urea cycle. Clinical application-Inborn error of Amino/Protein metabolism.

(d) Clinical Applications of biochemistry.

Reference Books:

1. Jain, J.L, *Fundamental of Biochemistry*, S. Chand Publication
2. Lehninger, Albert T., *Biochemistry,* Kalyani Publication
3. William, H. Elliott, *Biochemistry & Molecular biology*, Oxford Publication
4. Phillip, W. Kuchel, *Theory & Problems of Biochemistry*, Tata McGraw Publication, Delhi
5. Mathews, Christopher K., *Biochemistry,* Pearson Education Publication
6. Palmer Trevor, *Enzymes*, Affiliated East Publication
7. Wilsom, Keith, *Principles & Techniques in Biochemistry*, Cambridge Publication
8. Powar, C.B, *Biochemistry*, Himalaya Publication
9. Murray, Robert K., *Harper's Illustrated Biochemistry*, McGraw Hill Publication
10. Rastogi, S.C, *Biochemistry*, Tata McGraw Publication
11. Hames BD; Hooper NM, *Instant Notes Biochemistry,* Viva Books Private Ltd, New Delhi

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Institute for Excellence in Higher Education (IEHE), Bhopal

B.Sc. (Honours): **PART-III** Semester: **VI**

SUBJECT: **Chemistry** PAPER: **Honours-II/Subsidiary**

Title: Physical Chemistry – II

Maximum Marks:**100**

SYLLABUS

I. Chemical Kinetics and Catalysis:

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

Radioactive decay as a first order phenomena. Experimental methods of chemical kinetics, conductometric, potentiometric, optical methods, polarimetry and spectrophotometer.

Theories of chemical kinetics: Effect of temperatures on rate of reaction, Arrhenius equation, concept of activation energy, simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis). Expression for the rate constant based on equilibrium constant and Thermodynamic aspects. Catalysis, characteristics of catalyzed reactions, classification of catalysts miscellaneous examples.

II. Electro Chemistry – I

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

Debye Huckel - Onsager's equation for strong electrolytes (elementary treatments only). Transport number, Its definition and determination by Hittorf method and moving boundary method.

Application of conductivity measurement, determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

III. Electrochemistry-II:

Types of reversible electrodes - gas-metal ion, metal-metal 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 potential, Sign conventions, electrochemical series and its significance. Electrolyte and Galvanic cells: reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell EMF. Calculation of Thermodynamic quantities of cell reactions (ΔG, ΔH and K), polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_aDetermination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.

Buffers: Mechanism of buffer action, Henderson-Hessel batch equation. Hydrolysis of salts.

Corrosion: Types, theories and methods of combating it.

IV. Physical Properties and Molecular Structure:

Optical activity, polarization – (ClausiusMossotti equation), Orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment – temperature method and refractivity methods, dipole moment and structure of molecules, magnetic properties, Paramagnetism, diamagnetism and ferromagnetism.

V. Photochemistry:

Introduction of radiation with matter, difference between thermal and photochemical process, Laws of photochemistry: Grothus-Drapper Law, Stark – Einstein Law, Jablonski diagram depicting various process occuring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative process (internal conversion, intersystem crossing) quantum yield, photosensitized reaction, energy transfer process (Simple examples).

VI. Spectroscopy:

Introduction, electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born Oppenheimer approximation, degrees of freedom.

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

Vibrational Spectrum: Infrared spectrum, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.
Electronic spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck Condon principle.

Qualitative description of σ, π and η M.O., their energy levels and the respective transitions.

VII. Solution, Dilute Solution and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity co-efficient, Dilute solutions, colligative properties, Raoult's Law, relative lowering of vapour pressure, molecular weight determination. Osmosis, Law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression of freezing point Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point, Experimental methods for determining various colligative properties Abnormal molar mass, degree of dissociation and association of solutes.

Reference Books:

1. Singh N.B., *Physical Chemistry*, Dominant Publication
2. Laidler Keith J., *Chemical Kinetics*, Pearson Education Publication
3. Berry R.Stephan, *Physical Chemistry*, Oxford Press Publication
4. Yadav J.B., *Physical Chemistry*, GoelPublication
5. Raj Gurdeep, *Advanced Physical Chemistry*, Krishna Prakashan
6. Laidler J. Keith, *Physical Chemistry*, CBS publication
7. Castellan GilbertW., *Physical Chemistry*, Narosa publication

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. PREVIOUS Semester: I

SUBJECT: CHEMISTRY PAPER: I

TITLE: Chemistry of Transition Metal Complexes

Max. Marks: **140**

SYLLABUS

I. (A) ***Metal-Ligand Bonding***

Limitation of crystal field theory, Molecular orbital theory for bonding in octahedral, Tetrahedral & square planar complexes.

(B) ***Metal Ligand Equilibrium in Solution***

Stepwise & overall formation constant & their interaction. Trends in stepwise constant. Factors affecting the stability of metal complexes with reference to the nature of metal ions & ligands, chelate effect, Determination of binary formation constant by potentiometer & spectrophotometer.

II. ***Reaction Mechanism-I***

Reactivity of metal complex, inert & labile complexes, Kinetic application of valence bond & crystal field theory, Kinetics of octahedral substitution reactions, acid hydrolysis, Factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism. Direct and Indirect evidences in favour of conjugate mechanism, Anation reactions, reactions without metal ligand bond cleavage.

III ***Reaction Mechanism-II***

Substitution reactions in square planar complex, Trans effect, mechanism of substitution reaction, Redox reaction, Electron transfer reaction, mechanism of one electron transfer reaction, outer sphere type reaction.

IV. (A) ***Electronic Spectral Studies of Transition metal complexes***

Spectroscopic ground states, correlation Orgel & Tanabe-Sugana diagrams for transition metal complexes (d1-d9 states), selection rule for electronic spectroscopy. Intensity of various type electronic transitions. Calculation of Dq & B parameters, charge transfer spectra.

(B) ***Magnetic properties of transition metal complex***

Magnetic property & determination of magnetic susceptibility, anomalous magnetic moments, quenching of orbital contribution, orbital contribution to magnetic moment, magnetic exchange coupling & spin cross over.

V. ***Transitional metal π complexes***

Structure & bonding in metal carbonyl & nitrosyl compound. Transition metal π complexes with unsaturated organic molecules like alkenes, alkynes, allyl.

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2. 5. 8. 11. 25.4.18
3. 6. 9.

References:

1. *Advanced Inorganic Chemistry*, F.A. Cotton and Wilkinson, John Wiley.
2. *Inorganic Chemistry*, J.E. Huhey, Harpes & Raw.
3. *Chemistry of Elements*, N.N. Greenwood and A. Earnshaw, Pergamom.
4. *Magnetiochemistry*, R.J. Carlin, Springer Verlag.
5. *Comprehensive Coordination Chemistry,* G. Wilkinson, R.D. Gillars and J.A. Cleverty, Pergamom.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: **PREVIOUS** Semester: **I**

SUBJECT: **CHEMISTRY** PAPER: **II**

TITLE: Organic Chemistry- Reaction Mechanism

Maximum Marks: **140**

SYLLABUS

1. **Nature of bonding in organic compounds**
   - Concept of hybridization, sigma and pi bond, polar and steric effects (i) Types of bond cleavage (ii) Intermediates (iii) Reagents and (iv) Reactions.

2. **Mechanism of chemical reactions involving carbocation intermediates/transition state:**
   - **Nucleophilic substitution at a saturating carbon atom (aliphatic):**

     Types of mechanism –SN^1, SN^2 & SN^i. Effect of (i) solvent (ii) structure (iii) entering and leaving group on proposed mechanism.

     Kinetic and stereochemical studies (i) inversion (ii) racemisation (iii) retention of configuration –neighbouring group participation.

   - **Electrophilic addition to c=c & c=c-c=c system**

     Mechanism of addition with common addendum (X_2, H_2, HX, O_3, Hydration, carbocation, hydroxylation) stereochemistry, orientation, reactivity of substituted substrate (effect of substitution on rate of addition).

     Electrophilic substitution to benzene and it's derivatives with reference to kinetic and theromodynamic control.
     Energy profile diagrams, Directing influence of groups, O/P ratio, partial rate factors and selectivity.

   - **Elimination reactions:**

     α elimination; E-1, E-1cB and E-2 mechanism, Stereoselectivity, Orientation, Saytzeff vs. Hofmann; factors affecting Saytzeff and Hofmann elimination, Elimination vs. Substitution, effect of activating groups. 1, 1 (α) elimination.

   - **Rearrangement at electron deficient atom:**

     Carbocation rearrangement
     - With change in carbon skeleton - Pinacole Pinacolone rearrangement
     - Without change in carbon skeleton - Allylic rearrangement.
     - Rearrangement to electron deficient nitrogen atom - Backmann rearrangement
     - Rearrangement to electron deficient oxygen atom - Baeyer-villiger oxidation

3. Mechanism of chemical reactions involving carbanion intermediates/transition states:

- **Nucleophilic** addition c=c, c=o, c=c-c=o
- **Structure** and reactivity of carbonyl group, simple addition reactions, addition of alcohol, addition of carbanion to different carbonyl derivatives- Perkin, knoevenagel and Stobbe, Claisen ester condensation, addition of electron, metal hydrides.
- **Addition to c=c, Cyanoethylation Michael reaction.**
- **Add**ition to c=c-c=o
- **Nucleophilic substitution in aromatic compounds:**

  Substitution of hydrogen and atoms other than hydrogen
- **Rearrangement to electron rich atom (electrophilic rearrangements)**

  Wittig rearrangement.

4. Mechanism of chemical reactions involving free radical intermediates:

Addition to >c=c<: Halogen; hydrogen bromide; polymerization

Substitution of alkanes: Halogenation

5(a) Organic photochemistry:

- Photochemical energy, electronic excitation, excited states, modes of dissipation of energy, energy transfer, intramolecular energy transfer, quantum efficiency.
- Photochemistry of carbon compounds, Norrish type I & II reactions; photochemical reactions of cyclic ketones, Paterno Buchi reaction. Photo-chemistry of α-β unsaturated ketones.
- Photochemistry of olefins-cis-trans isomerism, dimerisation, butadiene photochemistry.

5(b) Pericyclic reactions:

Conservation of molecular orbital symmetry, properties of molecular orbitals.

- Electrocyclic reactions – correlation diagram and FMO method
  Cyclobutene - butadiene and cyclohexadiene- hexatriene system.
- Cycloaddition reaction – correlation diagram and FMO method
  Ethylene to cyclobutene system, ethylene and butadiene to cyclohexene system.
- Sigmatropic rearrangement : FMO method
  Suprafacial and Antarafacial process, analysis of sigmatropic rearrangement Cope and Claisen rearrangements.

References

1. *A Guide Book to Mechanism of Organic Chemistry*, Peter Sykes, Pearson education.
2. *Advance Organic Chemistry*, F.A. Carey and R.J. Sunderg, Plenum.
3. *Advance Organic Chemistry – Reaction, Mechanism and Structure*, Jerry March and John Wiley.
4. *Organic Chemistry*, R.T. Morrison and R.N. Boyd, Prentice Hall.
5. *Reaction Mechanism in Organic Chemistry*, S.M. Mukerji and S.P. Singh, McMillan.
6. *Pericyclic Reactions*, S.M. Mukherji, McMillan, India.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: PREVIOUS **Semester: I**

SUBJECT: CHEMISTRY **PAPER: III**

TITLE: Physical Chemistry

Max. Marks: **140**

SYLLABUS

I: Chemical Dynamics

Methods of determining rate laws, collision theory of reaction rates, steric factors, activated complex theory. Arrhenius equation and the activated complex theory, ionic reactions, kinetic salt effect, steady state kinetics, kinetics and thermodynamic control of reaction, treatment of unimolecular reactions. Dynamic chain reaction (Hydrogen-Bromine, Hydrogen Chlorine, Pyrolysis of acetaldehyde, decomposition of ethane and oscillatory reactions). General features of fast reaction, study of fast reactions by flow method relaxation method, flash photolysis and nuclear magnetic resonance method, dynamics of unimolecular reaction (Lindermann Hinshelwood and Rice-Ramasberger-Kassel-Marcus (RRKM) theories for unimolecular reactions).

II: Classical Thermodynamics

Brief resume of the 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. Determination of these quantities, Concept of Fugacity and determination of fugacity, non-ideal behavior.

III: Statistical Thermodynamics

Concepts of distribution, thermodynamic probability and most probable distribution, Ensemble averaging, postulation of ensemble averaging, canonical, grand canonical and micro canonical ensemble, Corresponding distribution laws (using Lagrange's method of undetermined multipliers) Partition function- translation, rotational, vibrational and electronic partition functions.

IV: Quantum Chemistry

(A) **Fundamentals:** Review of Classical Mechanics, General formulations of quantum mechanics, Schrödinger equation and the postulates of quantum mechanics, Discussion of solutions of the schrodinger equation to sum model systems *viz.*, particle in a box, the harmonic oscillator the rigid rotor, the hydrogen atom.

(B) **Approximate methods:** The various theorem, linear variation principle, Application of variation method, Eigen value of angular momentum operations using ladders operators.

V: Electrochemistry

Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion solvent interaction, Debye-Huckel-Bjerrum mode, thermodynamics of electrified interface equation. Electro capillarity, lippmann equations (surface excess), methods of determination, structure of electrified interfaces, Overpotentials, exchange current density, derivation of Butler Volmar equation, tafel plot. Quantum aspects of charge transfer at electrodes-solution interface. Polarography theory, ilkovic equation, half wave potential and its significance.

Books Suggested:

1. *Physical Chemistry* : P.W. Atkins ELBS
2. *Chemical Kinetics* : K.J. Laidler, McGraw-Hill
3. *Physical Chemistry* : B.K. Sharma, Krishna Prakashan Media Pvt. Ltd.
4. *Physical Chemistry* : Gurdeep Raj
5. *Physical Chemistry* : Gurtu & Gurtu
6. *Physical Chemistry* : Gurdeep Raj and Harish
7. *Thermodynamics* : Glasston
8. *Kinetics & Mechanism of Chemistry Transformation*: J. Rajaraman & J. Kuriacose, Mc Millan.
9. *Physical Methods in Chemistry*: R.S. Drago, Saunders.
10. *Molecular Quantum Mechanics*: P.C. Atkins & R.S. Friedman.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: PREVIOUS **Semester: I**

SUBJECT: CHEMISTRY **PAPER: IV**

TITLE: Chemical Hazard and Management

Max. Marks: **140**

SYLLABUS

I. Understanding of Chemical Hazards:

- Understanding of Basic terms: Hazards, risk, vulnerability, Disasters
- Types and characteristics of Chemical hazard: Fire, Explosion, toxic release
- Hazardous Chemicals: Definitions and Categorization as per regulatory provisions
- Hazardous properties and Safe handling of following Hazardous Chemicals: Chlorine, Sulphuric acid, Propane, Hydrogen Sulphide, Acetone, Liquefied Petroleum Gas.

II. Fire and Explosion Hazards:

Basic understanding of Fire and Explosion incidents, Initiating Factors for Fire and Explosions, Types of fire, Chemistry of fire, Industrial fire, Flash point, Auto ignition temperature, explosive limit, Extinguishing Agents, Water and its extinguishing properties, Carbon dioxide and its extinguishing properties, Dry chemicals and dry powders and its extinguishing properties, Carbon tetrachloride and its extinguishing properties, Foam and its extinguishing properties, halogenated extinguishing agents, Fire protection equipment.

Types of Explosion: Basic understanding of Boiling Liquid Expanding Vapor Explosions and Vapor Cloud Explosions.

Case Study of San Juanico Disaster, sequence of events, the scale of disaster, failure of system, lessons of the disaster.

III. **Chemical Hazard Assessment:**

Basic concept of risk analysis for chemical accident, Methodology and basic Steps for risk assessment, Understanding of Domino effect

IV. **Hazardous waste management :**

Hazard information labeling system, TREM card, emergency information panel, Safety precaution in transportation of hazardous chemicals, Hazardous material emergency management codes. Case studies of accidents during transportation of hazards chemicals. Definition and characterization of Hazardous chemicals as per hazardous waste management rule 1989. Chemical, biological and thermal treatment of hazardous waste.

V. **Chemical disaster management**

Basic features of guidelines, responsibility of different stake-holders in Chemical emergency management

Books Suggested:

1.*Safe Handling of Hazardous Chemicals* – A.K. Rohatgi
2.*Chemical Hazards* – Lee (vol-1 and vol.- 2)

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: **PREVIOUS** Semester: **II**

SUBJECT: **CHEMISTRY** PAPER: **I**

TITLE: **Application of Spectroscopy to Structural Analysis**

Maximum Marks: **140**

SYLLABUS

1. **Ultra-Violet Spectroscopy:** Absorption of dienes, polyenes, carbonyl compounds,α, β unsaturated carbonyl compounds and aromatic compounds, Woodward Feiser rule & its applications.

2. **Infrared Spectroscopy:**

   (A) Vibration modes & bond stretching, absorption of common functional groups, electrical & steric effects, effects of hydrogen bonding, fingerprint region & interpretation of IR spectra.Applications of vibrational spectroscopy for investigating mode of bonding of ambidentate ligands (thiocyanate,nitrate,sulphate& urea).

   (B) **Raman Spectroscopy:**Classical & quantum theories of Raman effect. Pure rotational, vibrational & vibrational-rotational Raman spectra, selection rule, mutual exclusion principle, Resonance Raman Spectroscopy, Coherent Antistokes Raman Spectroscopy (CARS)Comparison of IR & Raman Spectroscopy.

3. **(A)** **PMR Spectroscopy:**Interpretation of spectra, chemical shift, shielding mechanism & anisotropic effects, chemical exchange & chemical shift in chiral molecules, Spin-spin interaction, naming spin system, magnitude of coupling constant: geminal, vicinal & long range couplings, Second order spectrum & analysis of AB, AMX & ABX systems. Simplification of Complicated Spectra - Aromatic induced shifts, spin decoupling, deuterium exchange, spectra at higher fields, Hindered rotation & rate processes.

   (B) Lanthanide shift reagents,^{1}H NMR of paramagnetic substances,COSY,NOESY,HETCOR

   (C) **CMR Spectroscopy:** General consideration, chemical shift, coupling constants, Off resonance decoupling, DEPT,Interpretation of simple CMR spectra.

4. MASS Spectroscopy

(A) Introduction, ion production, fragmentation, factors influencing ion abundance, single & multiple bond cleavage, rearrangement, cleavage associated with common functional groups, molecular ion peak, metastable ion peak, Nitrogen rule & interpretation of mass spectra.

(B) Fingerprint application & the interpretation of mass spectra, effect of isotopes on the appearance of mass spectrum, recognition of the molecular ion peak, Ionization techniques (E1 & FAB).

5. Symmetry and Group theory in chemistry

Symmetry elements and symmetry operation, definition of group, subgroup, Conjugacy relation and classes, point symmetry group, Schoonfilies symbols, representation of groups by matrices (representations for the Cn, Cnv, Cnh, Dnh group to be worked out explicitly), character of a representation.

The great orthogonality theorem (without proof) and its importance, character tables and their use, derivation of character table for C_2v and C_3v point group, symmetry aspects of molecular vibrations of H_2O molecule. Symmetry & shapes of simple AB_2, AB_3, AB_4 molecules on the basis of IR spectral data

Books Suggested

1. *Inorganic Electronic spectroscopy* - A.P.B. Lever, Elsevier
2. *Structural Methods in Inorganic Chemistry* - E.A.V., Ebsworth, D.W.H., Rankin and S. Cradock, ELBS.
3. *Infrared and Raman Spectra - Inorganic and Coordination Compounds* - H. Nakamoto, Wiley.
4. *Basic Principle of Spectroscopy* - R. Change, McGraw Hill.
5. *NMR, NOR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry* - R.V. Parish, Ellis Horwood
6. *Chemical Application of Group Theory* - F.A. Cotton, 3rd Edn., John Wiley & Sons, New York.
7. *Inorganic Chemistry* - G.L. Miessler& D.A. Tarr, 2nd Edn., Prentice Hall International Inc., London
8. *Symmetry and Spectroscopy of Molecular* - K. Veera Reddy- New Age International Pvt. Ltd.,New Delhi
9. *Application of Spectroscopy of Organic Compounds* - J.R. Dyers, Prentice Hall
10. *Introduction of NMR Spectroscopy* - R.J. Abrahim, J. Fishes & P. Loftus, Wiley
11. *Spectroscopic Methods in Organic Chemistry* - D.H. Williams, I. Fleming, Tata McGraw.
12. *Spectroscopic Identification of Organic Compounds*, 6th Edition, John Wiley, New York.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: Previous **Semester: II**

SUBJECT: CHEMISTRY **PAPER: II**

TITLE: Mathematics and Computers for Chemists

Max. Marks: **140**

Part-A: **Mathematics for Chemists** Max marks: **70**

SYLLABUS

I. *Vectors and Matrix Algebra*

Vectors – dot, cross, triple product etc. Gradient, Divergence & Curl, Vector calculus, Gauss theorem, Divergence theorem *etc.*

Matrix Algebra – Addition & multiplications, inverse, adjoint & transpose of matrices.

II. *Differential Calculus*

Functions, continuity & differentiability, rules for differentiation, Application of differential calculus including maxima & minima (exact related to maximally populated rotational energy levels, Bohr's radius & most probable velocity from Maxwell's distribution etc.)

III. *Integral Calculus*

Basic rules for integration, integration by parts, partial fractions & substitution, reduction formulae, application of integral calculus. Function of several variables, partial differentiation, co-ordinate transformations (*e.g.* cartesian to spherical, polar)

IV. *Elementary Differential Equation*

Order & degree of differential equation, first order linear differential equation. Homogeneous, exact & linear equation, Application to Chemical kinetics, quantum chemistry *etc.*, Second order differential equation & their solution.

V. *Permutation & Probability*

Permutation & combination, Probability & probability theorems; Average, variance root mean square deviation, example from the kinetic gases *etc*; Curve fitting (including least square fit *etc*) with a general polynomial fit.

Books Suggested

1. *The Chemistry Mathematics Book* : E. Steiner, Oxford University Press
2. *Mathematics for Chemistry* : Doggett & Suiclific, Longman
3. *Mathematics 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 Chemistry* : Tebbutt, Wiley

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. Previous — **Semester: II**

SUBJECT: CHEMISTRY — **PAPER: II**

TITLE: Mathematics and Computers for Chemists

Part-B: **Computers for Chemists** — Max marks: **70**

SYLLABUS

I. Introduction to Computer and Computing

Basic Structure and functioning of Computers with a PC as an illustrative example. Memory, I/O devices, Secondary storage, Computer languages. Operating System with DOS as an example. Introduction to UNIX & WINDOWS. Data processing, Principles of programming. Algorithms & flow charts.

II. Computer Programming in C

Elements of the Computer language, Constants & variables, Operations & Symbols, Expressions, Arithmetic assignment statement, Operators.

Branching Statement – such as *if, if.....else*, nested *if-else*, ladder *if-else*.
Looping – *while, do-while* & *for*. Controls statements - *break, continue* & *goto*.
Functions – User defined function, returning a value from function, local and global variables, automatic variables, static variables, external variables, declaration of a function, recursion.
Array – Declaration and initialization of 1D & 2D array, String functions (*strcpy, strlen, strcmp* and *strcat*)

III. Programming in Chemistry by C Language

Development of small computer codes involving simple formula in chemistry such as solution of Vander Waal equation, pH titration, kinetics, radioactive decay. Evaluation of lattice energy & ionic radii from experimental data. Determination of normality, molarity, molality of solution Electronegativity of atom. Linear simultaneous equation to solve secular within the Huckle theory.

IV. Use of Application Packages

Introduction to application packages such as MS-WORD, MS-EXCEL, special emphasis on calculation & chart formation and its interpretation (Trendline & Forecasting).

V. INTERNET

Application of INTERNET for Chemistry with search engines, downloading & uploading of files.

Books Suggested

1. *Fundamental of Chemistry* : P.K. Sinha, B.P.B Publication
2. *Programming in ANSI C* : E. Balagurusamy, Tata McGraw Hill
3. *Computation Chemistry* : A.C. Norris
4. *Fundamental of Computer* : V. Rajaraman, Prentice Hill
5. Computer in Chemistry : K.V. Raman, Tata McGraw Hill
6. *MS Office 2000* : Gini Counter, B.P.B. Publication

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: PREVIOUS **Semester: II**

SUBJECT: CHEMISTRY **PAPER: III**

TITLE: Instrumentation and Analytical Chemistry

Max. Marks: **140**

SYLLABUS

I. *SAMPLING:*

Introduction, getting a meaningful sample, Sample preparation and types of samples.

A- *Air sample collection and analysis*: General consideration of size, rate, duration, storage. Techniques for gases and vapours, gas sampling vapours, static sensors, entrapment, real-time analysis.

B- *Liquid sample collection and analysis*: Methods discrete sampling, composite sampling, sampling pre-treatment, analysis.

C- *Solid sample collection*: Types (a) Bulk sample (b) stratified (segregated sample) (c) discrete unit.

II. *SEPERATION METHODS:*

Introduction, Classification of separation methods, Maximum capacities, Efficiency of separation methods.

A- *Liquid-Liquid extraction*: Distribution relationship, solvent extraction system. Liquid-Liquid extraction in hydrometallurgy, special extraction systems, Limitation of Liquid – Liquid extraction, Solid phase extraction.

B- *Membrane separation*: Driving force, physiochemical theory of membrane separation, membrane material, non-separation with applied pressure, ultrafiltration, Reverse osmosis, Dialysis, Electrodialysis.

C- *Electrophoresis*: Principle, working and Applications Types of electrophoresis: , Gel electrophoresis, Capillary electrophoresis, Low voltage electrophoresis, Thin sheet electrophoresis.

III. *CHROMATOGRAPHY:*

Introduction, Classification, Principles of chromatographic separation, and applications

A- Plane chromatography:

1. Paper chromatography.
2. TLC: Introduction, Types – 2D TLC, HPTLC.

B- Liquid Chromatography

1. *HPLC*: Principle, Equipment (mobile phase supply system, sample injection system, column, detector). and Applications
2. *Ion exchange*: Cation-anion exchange resin, effect of pH. and their Applications
3. *Gas Chromatography*: Introduction, Types: Gas-Solid (adsorption), Gas-liquid (partition), Types of column. Capillary application.

IV: *STATISTICAL TREATMENT OF ANALYTICAL DATA:*

Limitation of analytical method, Classification system of error, Accuracy, Precision, mean and standard deviation, how to reduce systematic errors, Reliability of result, Confidence interval, Rejection of measurement, Confidence limits test of significance, Significant figure and computation – Statistical evaluation of data, Computation rule - Method for reporting analytical data, Student **t**-test, Paired **t**-test, Chi-square test.

V: *INSTRUMENTATION:*

Basic components of analytical instrument, Principles of instrumentation, Working and Applications of-

1. Refractometer
2. Colorimeter
3. Flame-photometer
4. Nephelometer
5. Turbidometer
6. Flourimeter
7. Spectrophotometer
8. Thermo-gravimeter analysis Instrumental, TG curve
9. Atomic Absorption spectrophotometer

Books Suggested:

1. Vogel's *Textbook of Quantitative Chemical Analysis*: J. Mendham, R.C. Denney, Publisher-Pearson Education
2. *Quantitative Chemical Analysis*: Daniel C. Harries, Publisher: W.H. Freeman.
3. *Analytical Chemistry*: B.K. Sharma, Publisher: Krishna Prakashan Media Pvt. Ltd.
4. *Analytical Chemistry*: Gary D. Christian, Publisher: WSE Wiley
5. *Separation Method*: M.N. Shastri, Publisher: Himalaya Publishing House

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: PREVIOUS **Semester II**

SUBJECT: CHEMISTRY **PAPER: IV**

TITLE: Polymer Science

Max. Marks: **140**

SYLLABUS

I: Fundamental of Polymer

Basic concept of Polymer and history of Polymers. Classification, functionality and chemical/microstructure of polymer. Degree of Polymerization, molecular weight distribution, amorphicity and crystallanity of Polymers, Glass transition temperature (Tg) of polymers. Chemistry and Kinetics of polymerization-chain polymerization (Free radical chain polymerization, Cationic polymerization, Anionic Polymerization), Step growth polymerization (Polycondensation).

II: Molecular Weight and Processing of Polymers

Number average molecular weight, Weight average molecular weight and viscosity average molecular weight of polymers. Molecular weight determination methods like osmometry, light scattering, sedimentation, viscometry, cryoscopy, ebulliometry, ultra centrifugation, end group analysis and GPC etc.

Effect of molecular weight of polymers on properties of polymers.

Polymer processing: Introduction to injection moulding techniques, extrusion techniques, rotational moulding techniques.

III: Thermoplastic Materials

Commodity Plastic

Polyolefin - Polyethylene, LDPE, HDPE, LLDPE, HMHDPE,

Polypropylene - Homo-polymers, Copolymers.

Polystyrene & Styrene copolymers - Polystyrene, HIPS, ABS, Styrene Acrylonitrile

Vinyl plastics - Polyvinyl chloride

Acrylic plastics - Polymethyl Methacrylate, Polyacrylonitrile

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Engineering Plastics

Polyamides - Nylons 6, 66, 610, 11, 12 etc.

Polyesters - Polyethylene terephthalate, polybutylene terephthalate, polycarbonate

Polyacetals - Polyoxymethylene

Fluropolymers - Polytetrafluoroethylene

End user applications - case studies on applications in agriculture, building, electrical, electronics, industrial, packaging, medical, sports, transport, water management, telecommunication, toys etc.

IV: Testing and Characterization of Polymers

Importance of testing, physical (special gravity, MVTR), mechanical (tensile, flexural, impact and hardness), thermal (MFI, HDT, VSP, Flammability) and electrical properties (surface and volume resistivity, arc resistance, dielectric strength, CTI) of polymers, identification of polymers by simple techniques.

Polymers characterization techniques like - FTIR. DSC, TGA, TMA and GPC.

V: Thermosetting Materials

Synthesis, properties and applications of Phenol Formaldehyde (PF Resin), Urea Formaldehyde Resin (UF Resin), Melamine Formaldehyde (MF Resin), Unsaturated Polyesters (UP Resin), Alkyd Resin, Epoxies Resin, Polyurethane and Silicon Resin.

An introduction to Composites Materials - Definitions, properties of resins, fibres (Carbon fibre, glass fibre, Kevlar Fibre), Method of preparation of composite materials.

An introduction to Polymer Blends and Alloys - Definitions, advantages of polymers blends and alloys, role of composition, compatibility, properties and applications.

An introduction to Nano Materials - Polymer nanocomposites, nanoclay, carbon nanotubes, fullerenes - their advantages and applications in polymeric materials.

Books Suggested:

1. *Plastic Materials (Ed-7)* : Brdson, J.A.
2. *Hand Book of Plastics Materials & Technology* : Rubin, Irwin, J
3. *Plastics Materials Hand Book* : Athalye, A.S.
4. *Polymer Science* : Gowarikar, V.R. & others
5. *Text Book of Polymer Science* : Billmeyer, F.W.
6. *Introduction to Nanotechnology* : Charles P. Pool Jr. & Frank J. Owens
7. *Plastics Engineering Hand Book (Ed-5)* : SPI, Society of the Plastic Industry Inc
8. *Plastic Materials and Processing* : Schwartz & Goodman
9. *Plastic Materials and Processing Application* : *Birely & Scott*
10. *Modern Plastic Hand Book* : Harper

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Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: **FINAL** Semester: **III**

SUBJECT: **CHEMISTRY** PAPER: **I**

TITLE: **Fundamentals of Pharmaceutical Chemistry**

Maximum Marks: **140**

SYLLABUS

1. Introduction to drugs

Definition of pharmaceutical chemistry, Nature & source of drugs. Some important terminologies used in pharmaceutical chemistry-pharmacy, pharmacology, medicinal chemistry, pharmacodynamic, pharmacokinetics, molecular pharmacology, pharmacophore, antimetabolites, actimycetes, chemotherapy, pharmacopoeia, Pharmecognosy, Pharmacotherapeutics, classification and nomenclature of drugs, prodrugs and soft drugs.

2. Drugs design

(A) Development of new drugs, Drugs discovery without lead (eg. Penicillin). Concept of bio-active compounds, drug design, methods for Lead identification, Lead modification, SAR (Structure Activity Relationship). QSAR-Hansh equation, Hansh analysis method, free-Wilson analysis method.

(B) Theories of drug activity-clark occupancy theory, occupation theory, rate theory, induced fit theory, Thermopeutic ratio (derivation, numerical excluded) physico-chemical parameters.

3. Pharmacokinetics

(A) Definition, drug absorption, drug receptor interaction, basic ligand concept, agonist, antagonist, partial agonist, inverse agonist, drug distribution, drug elimination, drug disposition.

(B) Introduction to Pharmacokinetic, parameters (volume of distribution, clearance, bioequivalence), factors governing volume of drug distribution factors affecting absorption. Bioavailability, use of pharmacokinetics in drug development process.

4. Pharmacodynamics

(A) Definition, enzyme stimulation, enzyme inhibition, antidiabetic drugs-Introduction, mode of action of insulin & metformine.

(B) Xenobiotics, detoxication - Definition, site of detoxication, mechanism of detoxication oxidation, reduction, hydroxylation,hydrolysis, conjugation, detoxication of cyanide, general introduction of toxicological study of drugs.

5. Storage & application

Factors affecting stability of medication on storage, temperature effect, humidity effect, effect of gases, effect of light, container, Encapsulation. Application of pharmaceutical chemistry

Books Suggested

1. *Fundamental Concept of Applied Chemistry* - Jayshree Ghosh.
2. *Medicinal Chemistry-Ashutosh*, New Age International Publishers.
3. *A Textbook of Pharmaceutical Chemistry* - Jayshree Ghosh.
4. *Foye's Medicinal Chemistry* - Lemke Williams.
5. *Pharmaceutical Chemistry Inorganic* - G.R. Chatwal, Himalaya Publishing House.
6. *Text Book of Biochemistry* - D.M. Vasudeven, J.P. Publication.
7. *Pharmacology* - H.P. Rang, M.M. Dalp, P.K. Moora, J.M. Ritter.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc.: FINAL **Semester III**

SUBJECT: CHEMISTRY **PAPER: II**

TITLE: Biochemistry

Max. Marks: **140**

SYLLABUS

1. ***WATER, pH & BUFFER :***
   Water as a medium for biological reaction, concept of pH in terms of biological system, effect of pH on a biomolecules, biological buffers system.

   Bonding in biomolecules - H-bond, vander waal interaction, ionic bond, hydrophobic attraction, glycosidic linkage, peptide bond, phosphodiester linkage

2. ***BIOENERGETICS***
   Concept of energy, thermodynamic principles (without deviation), thermodynamics state function, high energy phosphate compounds, hydrolysis of phosphate bonds, redox potential, ETC, oxidative & substrate level phosphorylation.

3. ***METABOLISM OF BIOMOLECULES***
   Carbohydrate Metabolism - Glycolysis, oxidation of pyruvate to acetyl CoA, Kreb's cycle, Gluconeogenesis, glycogenesis, glycogenolysis, HMP shunt.
   Lipid - TG Hydrolysis, β Oxidation of FFA, Ketone bodies metabolism.
   Amino Acid: Transamination, Deamination, Decarboxylation, formation of Urea.

4. ***ENZYMES***
   Properties, classification & nomenclature, activation energy, transition state theory, concept of active site, theories for enzymes-substrate complex formation. Enzyme specificity. Metallo enzymes, Enzyme Inhibition.
   Mechanism of Enzyme Carboxypeptidase, Ribonuclease, Chymotrypsin, Lysozyme.
   Enzymes Catalysis: Acid-base catalysis, covalent catalysis with nature of catalysed and uncatalysed reaction.
   Enzyme Kinetics: Michaelis-menten equation line weaver – Burk equation, kinetics for competitive, non competitive and uncompetitive inhibitor.
   Bisubstrate reaction, enzyme isolation & purification, enzyme immobilization.

5. ***BIOCHEMICAL FUNTIONS OF INORGANIC IONS***
   Role of Ca^{2+}, K^{+}, Na^{+}, Mg^{2+}, Fe^{2+} in living system & their requirements and their application in biological system.

Books Suggested:

1. *Lehninger Principles of Biochemistry*: Nelson D.L. & Cox M.M. CBS Publication (2000).
2. *Enzyme* (*Biochemistry*): Trevor Palmer.
3. *Biochemistry:* Voet D. & Voet J.G., John Wiley & Sons.
4. *Harper's Illustrated Biochemistry*: Lange Publication.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. : FINAL **Semester: III**

SUBJECT:CHEMISTRY **PAPER: III**

TITLE: Spectroscopy Diffraction Techniques and Solid State Chemistry

Max. Marks: **140**

SYLLABUS

I. *ELECTRON SPIN RESONANCE*

Basic principles, zero field splitting & kramer's degeneracy, factor affecting the 'g' value isotropic & anisotropic hyper fine coupling constant, spin Hamitonian, spin densities and Mc Connell relationship, measurement techniques, applications. Hyperfine coupling, spin polarization for atoms & transition metal ions, spin-orbit coupling & significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems & to inorganic free radicals such as PH_4 F_2 & BH_3.

II. *MOSSBAUER SPECTROSCOPY*

Basic principles, spectral parameters & spectrum display. Application of technique to the studies of (1) Bonding & structure of Fe^{2+} & Fe^{3+} compounds including those of intermediate spin (2) Sn^{2+} & Sn^{+4} compound-nature of M-L bond, co-ordination number, structure (3) Detection of oxidation state & in equivalent MB atoms

III. *NUCLEAR QUADRUPOLE RESONANCE SPECTROSCOPY*

Quadrupole nuclei, quadrupole moments, electric field gradients, coupling constant, splitting, applications.

IV. *(A) ELECTRON DIFFRACTION*

Scattering intensity V/s scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules, low energy electron diffraction & structure of surfaces.

(B) NEUTRON DIFFERACTION

Scattering of neutrons by solid measurement techniques, elucidation of structure of magnetically ordered unit cells.

V. SOLID STATE CHEMISTRY

(A) Basic concept of X-ray diffraction & its application to determination of crystal structure & crystal defects. 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 lattics & X-ray intensities, structure factor & its relation to intensity & electron density, phase problem, description for an X-ray structure, absolute configuration of molecules.

(B) **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.

Books Suggested:

1. *NMR, NOR, EPR and Moassbauer Spectroscopy in Inorganic Chemistry* – R.V. Parish, Ellis Horwood
2. *Investigation of Molecular Structure, Spectroscopic and Diffraction Methods* – B.C. Gilbert Bell and Hyman Lt. London 1984
3. *Infrared and Raman Spectra: Inorganic and Coordination Compounds* – H. Nakamoto, Wiley.
4. *An Introduction to Mossbaur Spectroscopy* Ed. – L. Jyay Pletun
5. *Basic Principle of Spectroscopy*, R, Chang, Mc Graw, Hill.
6. *Solid State Chemistry & Its Application* – A.R. West. Pennum
7. *Principle of the Solid State* – H.V. Keer & Wiley Eastern
8. *Solid State Chemistry* – N.B. Hannay.
9. *Solid State Chemistry* – D.K. Chakrabarty & New Wiley Eastern.

Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. Final **Semester-III**

SUBJECT: CHEMISTRY **PAPER : IV**

TITLE: RESEARCH METHODOLOGY

Max. Marks: 140

SYLLABUS

1. Understanding the Research Process

Types of Research, Fundamental of Pure Research, Applied Research Action Research, Historical Research, Experimental Research, what is Scientific Research, Characteristics of Scientific Methodology, Qualities of Good Researcher, General rule of Academic Research, Types of research, Steps of Scientific Research

2. Problems of Identification and Preparatory Work

Exploratory field work & Identification the research area, narrowing on a specific topic,what is literature survey, role of literature survey and field work, formulating and delaminating a problem, Defining aims and objectives.

Computer Searches of literature

ASAP Alert, CA alerts, SciFinder, ChemPort, Science direct, STN international, Journal Home pages

3. Research Design

What is Research Design, preparing a Research Design, Steps in research design. Hypothesis testing in scientific research, sources of chemical information: primary, secondary & tertiary sources, indexes and abstracts in science and technology, chemical abstract, chemical titles, citation index.

4. Methodology, Method Tools and Techniques

Method of research: Survey research, case studies, qualitative and quantitative method, Ethnographic method.
Tools &Techniques: Observations, analytical instrumentation techniques.

5. Data Processing& Analysis Interpretation

Data processing, classification & categorization of data, data analysis, statistical method and statistical tools. data interpretation using computer and technology for research (chemical software).

6. Report Writing

Research ethics, avoiding plagiarism, quotations short medium and long, internet citation, foot note, writing a research paper, publication, instruction spacing, numbering heading margin, ibid etc. How to prepare ppt presentation and presentation technique. Report writing based on projects/assignments Institutional/Industrial tours and visits.

References Books :

1. Research methodology by Kothari.
2. Joseph,A. methodology for research: theological publication: banglore,1986
3. Gibaldi,J.Achtert,W.S Handbook for writers of research papers: 2nd ed :wiley Eastern,1987.
4. H.M.Kanare,writing the laboratory notebook:American chemical society:Washington DC,1985

B.sc I Semester I [Hons. I]

Title : Analytical Chemistry Practical

Max. Marks: 100

SYLLABUS

Laboratory Equipments & techniques

(A)Weighing techniques.

(i) Preparation of standard solutions.
(ii) Calibration of glassware's.
(iii) Calibration of thermometer's.

(B) Volumetric analysis:-

(i) Acid-base titration.
(ii) Redox titration.
(iii) Precipitation titration.
(iv) Complex metric titration.

(C)Separation techniques:-

(i) Paper chromatography Paper chromatography
(ii) TLC chromatography
(iii) Column chromatography

Scheme of Practical Exam.

Excer. 1	A	20 Marks
Excer.2.	B	20 Marks
Excer.3.	C	20 Marks
Excer. 4	Record	20 Marks
Excer.5.	Viva	20 Marks

1 4 7 10

2 5 8 11 25.4.18

3 6 25.4.18 12

B.sc I Semester I [Hons. II/Subsidiary]

Title : Inorganic Chemistry Practical

Max. Marks: 100 Duration : 04 Hrs

SYLLABUS

(A) Qualitative analysis:-

(i) Mixture analysis for 5 radicals ,Interfering & typical combinations.

(B) Volumetric analysis:-

(i) Estimation of commercial vinegar.

(ii) Estimation of Fe^{2+} & Fe^{3+} in mixture.

(C) **Spot Test for anions & cations.**

(D) **Laboratory safety measures.**

(i) Hygiene

(ii) Hazards

(iii) Waste disposals

Scheme of Marks :

1.	Qualitative Analysis	30 Marks
2.	Volumetric Analysis	20 Marks
3.	Spot Test	10 Marks
4.	Practical Record	20 Marks
5.	Viva	20 Marks

B.sc I Semester II [Hons. I]

Title : Environmental Chemistry Practical

Max. Marks: 100

SYLLABUS

(A) Analysis of water /soil

(i) Sampling techniques
(ii) pH
(iii) Conductivity.
(iv) TDS, Turbidity
(v) Acidity & Alkalinity.

(B) Analysis of water

I)Hardness

(ii)BOD

(iii)COD

(iv)DO

(v)Chlorine

(C) Analysis of soil

(i) Phosphate

(ii)Ammonia content

(D) Spot Test in water/soil sample.

(E) Green chemistry ,Eco friendly techniques.

Scheme of Practical Exam.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer.3.	C	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 Marks

1 4 7 10

2 5 8 11 25.4.18

3 6 9 12

B.sc I Semester II [Hons. II]

Title : Organic Chemistry Practical

Max. Marks: 100

SYLLABUS

(A)Systematic identification of organic compounds, its M.P./B.P. & derivative preparation.

(B) Purification of organic compounds.

(C) Preparation of organic compounds based on various name reactions & mechanism.

(D)Molecular weight determination,(cryoscopy & rast method)

(E)Standard operating procedure(sop) for laboratory.

Scheme of Practical Examination.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer. 3	C,D,E	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 Marks

B.sc II

Semester III

Title: Natural Product Chemistry Practical

Max. Marks: 100

SYLLABUS

(A)Estimation :-

(i) Determination of sugar, ascorbic acid , lipids , oxalic acid calcium & magnesium in natural product.

(B)Extractions from natural products:-

(i) Extraction of caffeine, Piperine, nicotine plant glue, essential oils in natural product.
(ii) Extraction of casein in natural product.
(iii) Extraction of polyphenol & tannic acid in natural product.

(C) Chemical Analysias

(i) Phytochemical test in natural product.
(ii) Dye test in natural product.
(iii) Food adultration in food sample

(D)Chromatography separation of :

(i) Chlorophill, Dyes, Lipids, Amino acids, component

Scheme of Practical Examination.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer. 3	C,D,	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 Marks

B.Sc. Part II Sem.: III Year: 2017-2018

TITLE: Physical Chemistry Practical

Syllabus

List of Practicals

Colloids

1. Preparation of colloidal solution of As_2S_3 and verify Hardy Schulz Law.
2. Preparation of colloidal solution of Fe $(OH)_2$ and verify Hardy Schulz Law.
3. Preparation of colloidal solution of $Al(OH)_3$ and verify Hardy Schulz Law.

Thermo Chemistry

1. Determination of the water equivalent of calorimeter and find out the value of heat of neutralization of strong acid and strong base.
2. Determination of the water equivalent of calorimeter and find out the value of heat of neutralization of strong acid and weak base.
3. Determination of the solubility of Benzoic acid in water and verify Von't Hoff reaction Isotherm equation.
4. Determination of the water equivalent of calorimeter and find out the value of heat of solution of H2SO4

Phase Rule

1. Determination of the C.S.T. of phenol-water system

2. Determination of the C.S.T. of phenol-water system and investigate effect of NaCl on C.S.T.
3. Determination of the C.S.T. of phenol-water system and investigate effect of Succinic acid on C.S.T.
4. Determination of the Transition Temperature of $Mncl_2.6H_2O$.
5. Determination of the Transition Temperature of $SrCO_3$.
6. Determination of the partition coefficient of Benzoic acid between water and benzene.
7. Determination of the partition coefficient of I_2 between CCl_4 and water

Scheme of Exam :

Excercise 1 : 30 marks (20+10 Marks for solution Prepration)

Excercise 2 : 30 marks (20+10 Marks for solution Prepration)

Sessional : 20 Marks

Viva : 20 Marks

BOOK SUGGESTED:-

1.Practical physical chemistry A.M James & F.E.Prichard,Longman.

2.Findley's Practical physical chemistry :B.P.Levitt,Longman.

3.Experiment physical chemistry:R.C.Das & B.C.Behera,Tata Mcgraw-Hill.

4.Practical Physical chemistry:Yadav

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B.Sc.Part II, Semester IV (Hons.I)

Title : Computer for Chemists (C Language) Practical

Max. Marks: 100 Duration : 03Hrs

SYLLABUS

1. **C Program based on Mathematical Problems :**
   a. Use of mathematical operators
   b. Calculating simple and compound interest.
   c. Area of a Circle and Area of Circle using power function.
   d. Calculate the square root
   e. Factorial of any Number
   f. Check the Number is Odd or Even
   g. Sum of first ten natural numbers
   h. Convert temperature in Fahrenheit to Celsius and vice versa
   i. Solution of Quadratic equation
   j. Aggregate & percentage marks
   k. Total number of months and days when user enters total days
   l. Similar other problems

2. **Specific C Programs (Based on Control statement/looping/ Arrays/ Strings/Functions/ File Management :**
   a. Convert temperature from Celsius to Fahrenheit or vis versa using *switch* statement
   b. Use of multiple mathematical operators with *switch* statement
   c. Program using *DO.... WHILE*
   d. Entered number is odd or even by using *if ... else*
   e. The greatest among three numbers by using *if* statement.
   f. Calculate sum of any numbers by using *for* loop
   g. Create 2 D array and display array elements
   h. Use of *string* function for addition of numbers
   i. Enter name with the use of *string* function
   j. Calculate the sum of array elements
   k. Construct matrix using 2D arrays
   l. Use of array to calculate the sum of numbers
   m. Open and close a file as file management
   n. Eligible for vote or not by using *goto*statement
   o. the sum of natural numbers by using *while* loop
   p. Print a table of any natural number by using *while* loop
   q. Find the average of n(n<10) by using 1D array

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r. Accept N numbers and arrange them in an ascending order based on sorting of array
s. Function with arguments and with return
t. Function with arguments but no return
u. Function with no arguments but return
v. Similar other programs

3. **C Program based on Chemistry Problems :**
   a. Compute pressure by using Vander Waal's Equation.
   b. Compute pressure by using ideal gas equation.
   c. Compute Vander Waal's constant a and b
   d. Program for Boyle's and Charle's Law
   e. Compute the number of half-life n by $N = N_0 [1/2]^n$
   f. Compute the half-life period of any radioactive substance
   g. Compute the energy of activation *Ea*on the basis of Arrhenius equation
   h. Compute Average Velocity, Root Mean Square and Most Probable Velocity of gaseous molecules
   i. Compute Molality, Molarity and Normality of a solution
   j. Compute pH of a solution and find that it is Acidic, Basic or Neutral solution by $pH = - \log [H^+]$
   k. Compute rate constant for first order and zero order reaction
   l. Compute rate constant for second order reaction when concentration of reactants is equal
   m. Compute lattice energy of any ionic compound
   n. Compute the average life period by $T = 1.44 \times t_{1/2}$
   o. Compute the decay constant of a radioactive substance
   p. Compute the bond order of any molecule
   q. Compute pH by pH = pKa + log [salt] / [Acid] and find that the solution is acidic, basic or neutral
   r. Compute Bohr radius of an atom
   s. Compute the lattice energy of any ionic compound
   t. Similar other problems

Schemes of Marks :

1.	C Program based on Mathematical Problems	20 Marks
2.	Specific C Programs	20 Marks
3.	C Program based on Chemistry Problems	20 Marks
4.	Practical Record	20 Marks
5.	Viva	20 Marks

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3 6 9 12
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B.Sc.Part II, Semester IV (Hons. II/ Subsidiary)

Title : Inorganic Chemistry Practical

Max. Marks: 100 Duration : 04Hrs

SYLLABUS

(A) Preparation of Complexes:

(i) Tetra aminecupric (II)sulphate.
(ii) *cis* Pottasiumdioxalatodiaquochromate(III)
(iii) Reineck's salt
(iv) Prussian Blue
(v) Sodium trioxalatoferrate(III) trihydrate etc.

(B) Quantitative Analysis : Gravimetric estimation of

(i) Ba as $BaSO_4$
(ii) Cu as CuCNS
(iii) Ni as NiDMG

(C) Determination of formula and stability constant of complexes by Job's or Slope Ratio Method :

(i) Ferrithiocyanate
(ii) Ferrisalicylate

Schemes of Marks :

1.	Inorganic Preparation	20 Marks
2.	Quantitative Analysis	20 Marks
3.	Instrumental Analysis	20 Marks
4.	Practical Record	20 Marks
5.	Viva	20 Marks

1 2 3 4 5 6 7 8 10 11 12 25.4.18

B.sc III

Semester V Hons. I

Title : Industrial Chemistry Practical

Max. Marks: 100

SYLLABUS

(A)Estimation :-

(i)Iron& Copper in given wire sample.

(iii)Acetic acid in vinegar.

(iv)Available oxygen in pyrolusite.e

(v)Avialable chlorine in bleching powder.

(B)Preparation of Thermosatting polymers

(i) Phenol-Formaldehyde resin.

(ii) Urea-Formaldehyde resin.

(iii)Thiokol rubber.

(iv)Plastic from potato starch

(c)Chemical Analysis

(i) Determination of Viscosity Of sample oil by redwood viscometer

(ii) Determination of surface tension Of lubricant.

(i) Determination of calorific value Of Fuel.
(ii) Determination of Iron in Cement.
(iii) Determination of flush point & fire point Of lubricant by Ables apparateS.
(iv) Determination of setting time of Cement.
(v) Determination of setting time of Cement.
(vi) Preparation of washing powder.
(vii) Preparation of cleaning solution.

Scheme for Practical Examination.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer.3.	C	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 marks

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B.sc III Semester V (Hons. II/Subsidiary)

Title : Organic Chemistry Practical

Max. Marks: 100

SYLLABUS

A. Separate and analyse Binary Organic mixture

B. Organic Preparations based on name reactions.

C. Estimation of Phenol, Aniline , Glycine & Glucose

Scheme of Practical Examination.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer. 3	C	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 Marks

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3 6 9 12

B.sc III Semester VI [Hons.

Title : Biochemistry Chemistry Practical

Max. Marks: 100

SYLLABUS

(A)Qualitative Analysis:-

Carbohydrates, Lipid &Protein & Amino Acids.

(B)Estimations of Biomolecules:-

Carbohydrates, Lipid &Protein & Amino Acids.

(C) Lipid Parameters

Saponification value, Acid value, Iodine value.

(D)Haematological Study:-

Collection , blood group Determination.

Scheme of Practical Examination.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer. 3	C,D,	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 Marks

B.Sc. Part III Sem VI Year : 2017-2018

TITLE: Physical Chemistry Practical

Max. Marks: 100

SYLLABUS

List of Practicals

(A) Kinetics

Ex. 1. Determination of rate constant of hydrolysis of methyl acetate catalyzed by 0.5 N HCl at room temperature.

Ex.2 Determination of the rate constant of hydrolysis of methyl acetate catalyzed by 0.5 N HCl 10 *c higher then room temperature.

Ex.3 Determination of the rate constant of hydrolysis of methyl acetate catalyzed by 0.5 N H_2SO_4 at room temperature.

Ex.4 Determination of the rate constant of hydrolysis of methyl acetate catalyzed by 0.5 N H_2SO_4 10 *c higher then room temperature.

Ex.5 Determination of the rate constant of hydrolysis of ethyl acetate catalyzed by 0.5 N HCl at room temperature.

Ex.6 Determination of the energy of activation of hydrolysis of methyl acetate catalyzed by .5N HCl.

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Ex.7 Determination of the relative strength of the acids by studying the hydrolysis of methyl acetate.

Ex.8 Determination of rate constant of hydrolysis of ethyl acetate catalyzed by 0.5 N H_2SO_4 at room temperature.

Ex. 9. Determination of velocity constant of hydrolysis of ethyl acetate by NaOH.(Saponification)

(B) Physical properties & Molecular structure

Ex. 1 Determination of the inversion in optical rotation of Cane sugar.

Ex2. Determination of the Surface Tension of the given solution by drop number method.

Ex.3. Determination of Viscosity of the given solution using Viscometer.

Ex.4. Determination of percentage composition of mixture by surface tension method.

Ex.5. Determination of percentage composition of mixture by Viscosity method.

Ex.6 Determination of the Parachor value of the given liquid.

Ex.7 Determination of the Reachor value of the given liquid.

(C) Electro Chemistry

1. Conductometric titration of Strong Acid and Strong Base & find out the end point.
2. Determination of the Strength of strong acid titrating with strong base using pH meter.

3. Determination of Solubility of a sparingly soluble salt.
4. Titration of a mixture HCl and CH_3COOH potentiometrically, and hence the composition of the mixture

(D) Photo chemistry

1. Determination of O.D. by Colorimeter or using spectrophotometer KMnO4
2. Determination of O.D. by Colorimeter or using spectrophotometer CuSO4
3. Verification of Beer-Lambert law.

Scheme of Exam :

Excercise 1 : 30 marks

Excercise 2 : 30 marks

Sessional : 20 Marks

Viva : 20 Marks

M.Sc. Previous, Semester I

Title : Inorganic Chemistry Practical

Max. Marks: 100 Duration : 06 Hrs

SYLLABUS

(A) Qulitative Analysis
- (i) Semi-micro method of mixture analysis with 5 radicals.
- (ii) Less common ion-Ti,Mo,w,Zr,Th,V,U ect.
- (iii) Insoluble –oxide,sulphates & halides.

(B) Quantitative Analysis:-Separation of cation containing two/three components by gravimetric and volumetric methods.
- (i) Cu-Ni
- (ii) Ni-Zn
- (iii) Cu-Fe
- (iv) Ba-Cu-Zn
- (iv) Ag -Cu-Zn
- (v) Ag-Cu-Ni

(C) Inorganic preparations-
- (i) Tetra amine cupric sulphate.
- (ii) Hexa ammine nickle chloride
- (iv) Mohrs salt
- (iv) Potash alum
- (v) Hexa ammine cobalt chloride
- (vi) Cis-Trans dioxalato diaquo chromate
- (viii) Potassium trioxalato ferrate
- (ix) Reinecks salt
- (x) Sod.trioxalato ferrate trihydrate.

(D) Interpretation of orgal digram of transition metal complexes.

Schemes of Marks :

1.	Qualitative Analysis	20 Marks
2.	Quantitative Analysis	20 Marks
3.	Inorganic Preparation	20 Marks
4.	Practical Record	20 Marks
5.	Viva	20 Marks

M.Sc Prev. **Semester I**

Title : Organic Chemistry Practical

(A) Estimations:-

(i) Estimation of functional groups-OH,NH2 ,OCH3

(B) Mixture Analysis:-

Binary &Tertiary organic mixture .

(C) Organic compound preparation:-

(I) One step preparation

(II) Two step preparation

(III) Three step preparation

Scheme of Practical Exam.

Excer. 1	**A**	**20 Marks**
Excer.2.	**B**	**20 Marks**
Excer.3.	**C**	**20 Marks**
Excer. 4	**Record**	**20 Marks**
Excer.5.	**Viva**	**20 Marks**

INSTITUTE FOR EXCELLENCE IN HIGHER EDUCATION, BHOPAL

M.Sc. FINAL	Year 2017-18	Semester-III

SUBJECT: CHEMISTRY **M.M -100**

TITLE - PHYSICAL PRACTICAL

SYLLABUS

I-CHEMICAL KINETICS

1.Determination of the effect of (a) Change of temperature.(b) Change of concentration of reactant & catalyst &(c)ionic strength of media on velocity constant of hydrolysis of an ester/ionic reaction.

2. Determination of the velocity constant of hydrolysis of an ester/ionic reaction in micelle media.

3. Determination of the velocity constant for the oxidation of iodide ions by hydrogen peroxide & study the kinetics as on iodine clock reactions.

4. Flowing clock reactions.

5. Determination of the primary salt effect on the kinetics of ionic reaction & testing of Bronsted relationship (iodide ion is oxidized by persulphate ion).

6. Oscillatory Reactions.

II. THERMODYNAMICS

1. Determination of partial molar volume of solute (e.g.KCl) & solvent in binary mixture.

2. Determination of the temperature dependence of the solubility of a compound in the two solvent having similar intermolecular interaction (benzoic acid in water & in DMSO water mixture) & calculate the partial molar heat of solution.

3. To find out transition temperature of binary mixture.

4. Determination of enthalpy of solution , enthalpy of neutralisation by calorimetric method.

5. Verification of Born-Haber cycle.

III ELECTROCHEMISTRY

1) Determination of solubility by (i) Conductometry (ii) Potentiometer.

2) Conductometric titration of polybasic acid.

3) Verification of Debye-Huckel-OnSagar equation of conductance.

4) Conductometric titration of triple mixture (HCl + NH_4Cl +KCl) with(i)NaOH (ii)$AgNO_3$.

5) Analysis of halide mixture by Potentiometry.

6) Potentiometry titration of strong acid & strong base using qunihydrone electrode.

7)Potentiometric titration of Redox system(FAS vs $K_2Cr_2O_7$.).

8) Determination of pH & pKa value Henderson's equation.

9) Determination of Sodium Carbonate content (in percentage) of washing soda using a pH meter.

10) Determination of temperature dependence of EMF of a cell.

11) Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.

12) Acid-base titration in a non-aqueous media using a pH meter.

13) Determination of the dissociation constant of acetic acid in DMSO,DMF,

Acetone and Dioxin by titrating it with KOH.

BOOK SUGGESTED:-

1.Practical physical chemistry A.M James & F.E.Prichard,Longman.

2.Findley's Practical physical chemistry :B.P.Levitt,Longman.

3.Experiment physical chemistry:R.C.Das & B.C.Behera,Tata Mcgraw-Hill.

4.Practical Physical chemistry:Yadav

Scheme of Exam :

Excercise 1 : 30 marks (20+10 Marks for solution Prepration)

Excercise 2 : 30 marks (20+10 Marks for solution Prepration)

Sessional : 20 Marks

Viva : 20 Marks

25-4-18

Institute for Excellence in Higher Education (I.E.H.E.), Bhopal

M.sc Prev. Semester II

Title : Instrumentation & Analytical Chemistry

Practical Syllabus

(A) Experiments based on following instruments:- their principle & working

(I) pHmeter
(II) Potentiometer

(iii) Conductometer

(iv) Colorimeter
(v) Spectrophotometer
(vi) Nephelometer
(vii) Fluorimeter
(viii) Flame photometer
(ix) Refractometer

(B) Separation Techniques

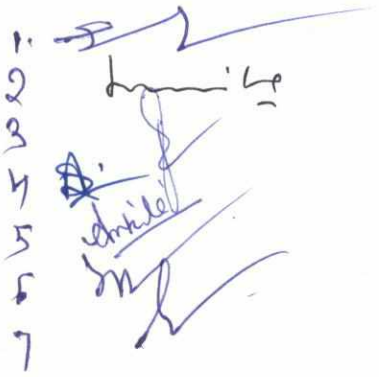
Chromatography-Paper, column,TLC,Ion exchange & Electrophoresis.

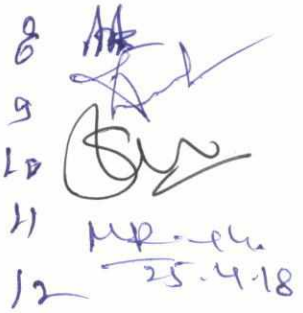
(C) Statistical Treatment of analysis of data through numerical problems :-

T test, Chi-square test, Accuracy, Precision , Mean , Standard Deviations & Rejection of data

Scheme of Practical Exam.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer.3.	C	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 marks





M.Sc. Previous Sem II

Title : Application of Spectroscopy

Max. Marks: 100

SYLLABUS

(A) Spectroscopic determination of nitrite/nitrate phosphate/ammonia in water or soil sample.

(B) Application of Job s methods

- (i) Continuous variation method
- (ii) Mole ratio method
- (iii) Slop ratio method

For Copper & Iron complexes.

(C) Determination of stability constant & stoichiometry of Fe-Salicylic acid constant , Fe-Phenanthrolene complexes.

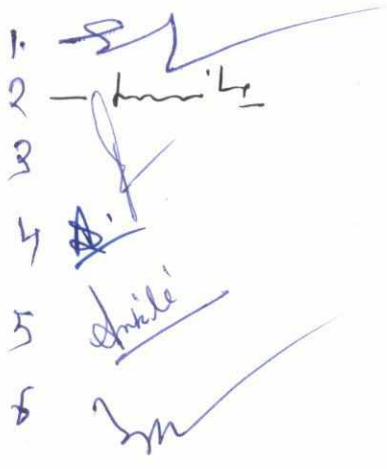
(D) Interpretation of Electronic spectrum of complex ions.

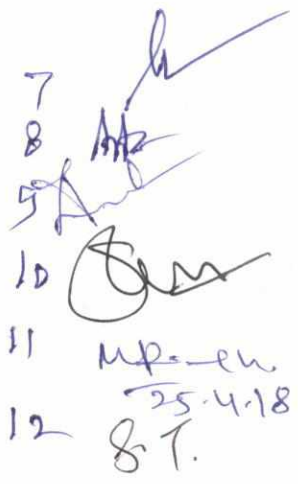
- (i) Electronic configuration
- (ii) Terms ,
- (iii) States
- (iv) Microstates
- (v) Spinmultiplicity

Example: $Cr[(NH_3)_6]^{3+}$, $Cr[(NH_3)_5\ X]^{2+}$, : $Ni\ [(NH_3)_6]Cl2$, : $Cu[(NH_3)_4]SO4$, : $Ni[(dmg)_2$, ect.

Schenme of Practical Exam.

1.	Ex. A	20 Marks
2.	Ex. B	20 Marks
3.	Ex. C & D	20 Marks
4.	Practical Record	20 Marks
5.	Viva	20 Marks





Institute for Excellence in Higher Education (IEHE), Bhopal

M.Sc. Prev.Semester II

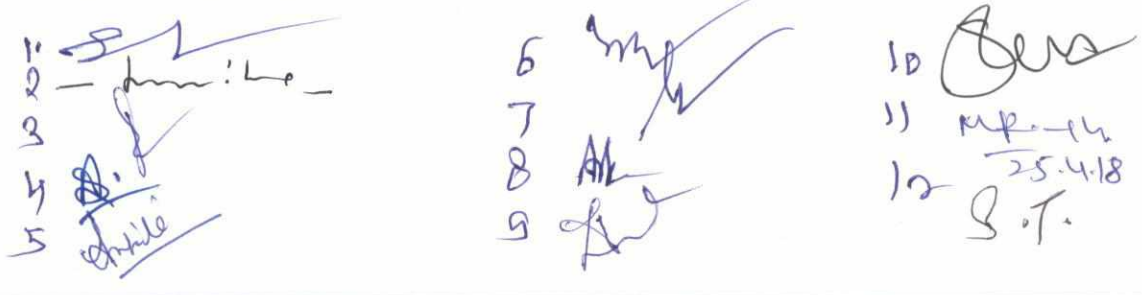
Title : Mathematics for Chemists and Computer For Chemists Practical

Max. Marks: 100 Time : 04Hrs

SYLLABUS

1. **C Program based on Mathematical Problems :**
   a. Read a,b,c and find roots of the equation $ax^2 + bx + c = 0$
   b. Use of mathematical operators
   c. Calculating simple and compound interest.
   d. Area of a Circle and Area of Circle using power function
   e. Calculate the square root
   f. Factorial of any Number
   g. Check the Number is Odd or Even
   h. Sum of first ten natural numbers
   i. Convert temperature in Fahrenheit to Celsius and vice versa
   j. Calculate real roots of quadratic equation
   k. Aggregate & percentage marks
   l. Total number of months and days when user enters total days
   m. Similar other problems

2. **Specific C Programs (Based on Control statement/looping/Arrays/ Strings/Functions) :**
   a. Convert temperature from Celsius to Fahrenheit or vis versa using *switch* statement
   b. Use of multiple mathematical operators with *switch* statement
   c. Program using *DO.... WHILE*
   d. Entered number is odd or even by using *if ... else*
   e. The greatest among three numbers by using *if* statement.
   f. Calculate sum of any numbers by using *for* loop
   g. Create 2 D array and display array elements
   h. Use of *string* function for addition of numbers
   i. Enter name with the use of *string* function
   j. Calculate the sum of array elements
   k. Construct matrix using 2D arrays
   l. Use of array to calculate the sum of numbers
   m. Eligible for vote or not by using *goto* statement
   n. Sum of natural numbers by using *while* loop
   o. Print a table of any natural number by using *while* loop
   p. Find the average of n(n<10) by using 1D array
   q. Function with arguments and with return, Function with arguments but no return, Function with no arguments but return
   r. Similar other programs

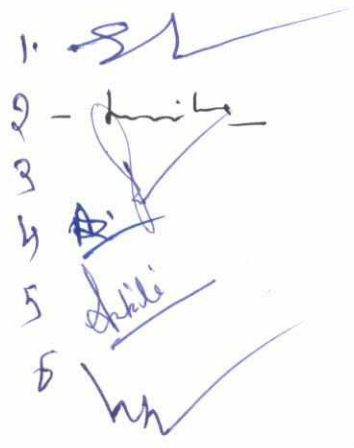


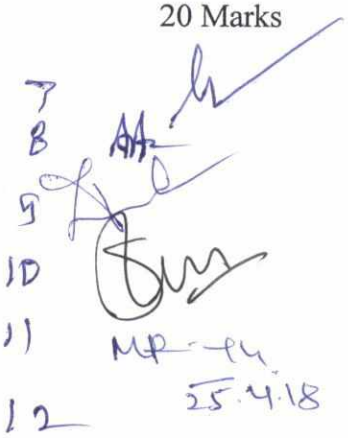
3. C Program based on Chemistry Problems :

a. Compute pressure by using ideal gas equation
b. Compute pressure by using Vander Waal's Equation.
c. Compute Vander Waal's constant a and b
d. Compute wave number of stokes and anti-stoke Raman lines
e. Compute the number of half-life n by $N = N_0 [1/2]^n$
f. Compute the half-life period of any radioactive substance
g. Compute the energy of activation *Ea* on the basis of Arrhenius equation
h. Compute Average Velocity, Root Mean Square and Most Probable Velocity of gaseous molecules
i. Compute Molality, Molarity and Normality of a solution
j. Compute pH of a solution and find that it is Acidic, Basic or Neutral solution by $pH = - \log [H^+]$
k. Compute rate constant for first order and zero order reaction
l. Compute rate constant for second order reaction when concentration of reactants is equal
m. Calculate binding energy of nucleus by $\Delta E = \Delta mc^2$ where c = 3* 1010, Δm = mass defect in amu.
n. Calculate increase in entropy by $\Delta S = q / T$ where q = specific heat of substance, T = temperature in Kelvin.
o. Calculate value of distribution coefficient as $C_1 / C_2 = K$, C_1= concentration of one substance in g / l, C_2 = concentration of second substance in g / l,
p. Compute the average life period by $T = 1.44 \times t_{1/2}$
q. Compute the decay constant of a radioactive substance
r. Frequency calculation for a photon by $v = c / \lambda$, $A = 10^{-8}$
s. Compute pH by pH = pKa + log [salt] / [Acid] and find that the solution is acidic, basic or neutral
t. Calculate lattice energy of a crystal using Born-Lande equation
u. Similar other problems

Schemes of Marks :

1.	C Program based on Mathematical Problems	20 Marks
2.	Specific C Programs	20 Marks
3.	C Program based on Chemistry Problems	20 Marks
4.	Practical Record	20 Marks
5.	Viva	20 Marks





M.Sc Final. **Semester III**

Title : Pharmaceutical chemistry

Max. Marks: 100

SYLLABUS

(A) Preparation of some medicinal compounds

(i) Anaesthatic Drugs-Diethyl ether, Chloroform ,

(ii) Hypotonic Drugs-Barbiturate, Barbitone

(iii) Anticonvulsant Drugs-Trimethadione.

(iv) (iv)(Antipyratic , Analgesi- Asprin, Salol , Phenasitin.

(v) Tranquilizers Drugs-Maprobamate

(vi) (vi)Sulpha Drug- P- Aminophenilamide,Sulphasatamide.

(B) Harble Analysis-

(i) Zinger ,Tulsi,Almond ,Lamen grass ,Cinnamon,Mulathi

(C) Estimaions From Drugs

(i) Iron, Zinc, Ca , Mg , Glucose ,Hydroxy, Amino groups

Scheme of Practical Exam.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer.3.	C	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 marks

Institute for Excellence in Higher Education (IEHE), Bhopal

M.sc Final **Semester III**

TITLE: Biochemistry

Max. Marks: 100

SYLLABUS

(A) Estimation of carbohydrate,Protein,Cholesterol,Ca,SGOT,SGPT.

(B) Enzymology

(i)Effect of amylase

(ii)Acromatic point of amylase

(iii)Effect of temperature on enzyme activity.

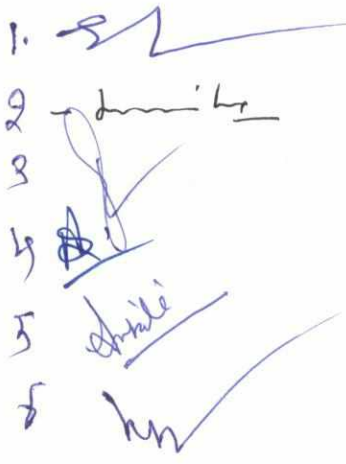
(iv) Effect of p H substrate concentration ,activator& inhibitor on enzyme activity.

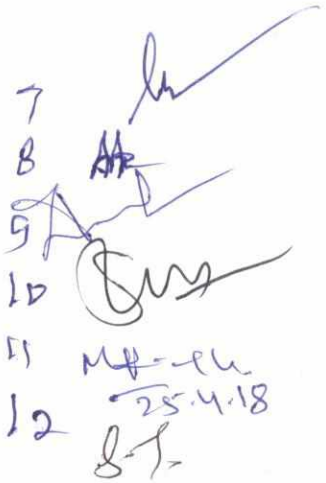
(C) Haematology study-collection of blood, blood group determination.

(D) Lipid parameter-Saponification value, Acid value, Iodine value

Scheme of Practical Exam.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer.3.	C&D	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 marks





M.sc Final **Semester III**

TITLE: Spectroscopy and structural analysis.

Max. Marks: 100

SYLLABUS

(A) Determination of Cu, Cr ,Al ,Fe , Zn By Spectrophotometer.

(B) Determination of NO3,SO4,By Spectrophotometer.

(C) Determination of Carbohydrates, Amino Acid ,Protein,& Ascorbic Acid By Spectrophotometer.

(D) Interpretation of spectra of organic compounds

(i)Interpretation of IR spectra of compounds with & without Functional Groups.

(ii)Interpretation of NMR spectra of compounds with & without Functional Groups.

(iii)Interpretation of Mass spectra of compounds with & without Functional Groups.

(iv) Interpretation of UV /Visible spectra of compounds.

(v)Structural & spectral problems.

(E) Interpretation of spectra of Metal Complexes

Scheme of Practical Exam.

Excer. 1	A	20 Marks
Excer. 2	B	20 Marks
Excer.3.	C	20 Marks
Excer. 4	Record	20 Marks
Excer. 5	Viva	20 marks