I Semester **Subject Code: 1MC01A**

MAIN PAPER – I

GENERAL CHEMISTRY – I

Unit - I

Atomic Structure-Planck's radiation law- Quantisation of energy - Einstein's theory of photoelectric effect. Bohr's theory of hydrogen atom (No derivation) and its defects. Sommerfeld's theory & Limitations . Dual behaviour of electron - de Broglie's theory of wave - particle dualism. Experimental evidence for wave property of electron - its significance. Heisenberg's uncertainty principle (or) complimentary principle-Compton effect.

Unit - II

Postulates of quantum mechanics. Schrödinger wave equation- Derivation. Conditions imposed on the wave functions. Setting up of Schrödinger wave equation –Particle in one dimensional box, Particle in three dimensional box & Simple Hormonic Oscillator. Quantum numbers - concept of orbitals and significance of ψ and ψ^2. Prabability distribution of electrons- Shapes of s, p, d and f orbitals. Stability of half-filled and filled orbitals.

Unit-III

Electronic Configuration - Aufbau principle, Pauli's exclusion principle and Hund's rule. Periodic properties - Atomic radius, ionic radius, ionisation energy or potential, electron affinity and electronegativity - Definition and variation along periods and groups. Explanation in terms of shielding effect and effective nuclear charge. Applications of ionisation potential and electron affinity - Tendency of elements to form cations and anions - Reducing and oxidising power of elements. (oxidising properties of halogens) - Metallic and non-metallic character of elements. Electronegativity - measurement - different scales of electronegativity.

Unit - IV

Covalent bond - Application of electronegativity - nature of bond, percentage of ionic character - calculation of ionic character from dipole moment data - calculation of bond length. Dipole moment and geometry of molecules. Ionic bond-Lattice energy - its determination by Born – Haber cycle - Factors affecting lattice energy. Ion polarisation and Fajan's rules. Hydrogen bond - Nature, types and effect on structure and properties . van der Waals' forces -Nature, types and factors affecting van der Waals' forces.

Unit – V

Shapes of molecules based on VSEPR theory – $BeCl_2$, BF_3, H_2O, NH_3, CH_4, PCl_3, PCl_5, ClF_3, SF_4, SF_6, and IF_7. Overlap of orbitals - valence bond method - molecular orbital method. Comparison of VB & MO theories. Molecular orbital diagram for H_2, He_2, Li_2, Be_2, B_2, C_2, N_2, O_2, O_2^+, O_2^-, F_2, Ne_2, CO, NO, HF and HCl.

Concept of hybridization sp^3, sp^2, sp – CH_4, C_2H_6, C_2H_4, C_2H_2, C_6H_6 and geometry of molecules. Directional character of covalent bond.

I Semester **Subject Code : 1MC02A**

MAIN PAPER – II

GENERAL CHEMISTRY - II

Unit – I

General safety in chemistry laboratory - Storage and handling of chemicals-Carcinogenic chemicals. Toxic gases - Carbon monoxide, Hydrogen sulphide, Hydrogen cyanide, Phosgene, Chlorine, Sulphur dioxide and Oxides of Nitrogen.Precautions with glassware, gas and electricity.Protective devices - Exhaust systems - Fume Disposal and Waste disposal.Precautions for avoiding accidents - Handling of ethers - Safe limits of vapour concentration. Goggles. A general knowledge of using different types of fire extinguishers to control the fire from chemicals, electricity, gas and oil bath. First aid techniques - Rules to avoid poisoning. Treatment of specific poisoning - alkalis, Acids, Bromine, Phenol, Phosphorus and its compounds Lead compounds and Copper compounds.

Unit - II

Types of reactions involved in qualitative analysis - Dry reactions, Precipitation reactions and Complex formation reactions. Common ion effect and Solubility product principle. Removal of interfering ions. Use of organic and inorganic reagents. Spot test reagents - aluminon, cupferon, DMG, thiourea, magneson, alizarin and Nessler's reagent. Semimicro techniques.

Unit - III

Nomenclature - Aliphatic organic compounds - Punctuation marks (hyphens, comma and enclosing brackets)

Classification of Reactions and Reagents.Reactions - Substitution, elimination and addition – Elementary treatment. Reagents - Electrophiles and nucleophiles.Homolytic and heterolytic fission - Free radicals, carbonium ions and carbanions.Polar effects - Inductive, inductomeric and electromeric effects.Resonance - Delocalisation. Hyperconjugation. Steric effects.

Unit-IV

Alkanes 1°, 2° and 3° carbons with examples - orientation and reactivity in halogenation - Mechanism. Free radical substitution. Selectivity, reactivity and stability in halogenation of alkanes.

Cyclo alkanes - Preparation using Wurtz's reaction, Dieckmann's ring closure and reduction of aromatic hydrocarbons. Substitution and ring opening reactions. Baeyer's strain theory and theory of strainless rings.

Liquid Fuels – Natural and crude petroleum.

Classification of crude petroleum – Paraffin , Asphaltic and Mixed base type.Derived fuels - Synthetic petrol.Elementary treatment of Fischer – Tropsch method and Bergius process. Cracking — Thermal and Catalytic cracking - Comparison. Advantages. Ignition temperature, Spontaneous Combustion & Calorific value.Combustion - Knocking and antiknocking reagents - octane number. Flash point, fire point and smoke point - definition only.

Unit -V

Alkenes - Preparation - dehydration of alcohol and dehydrohalogenation of alkyl halides - mechanism - Sytzeff's and Hofmann's rule - Intermediate - Carbocation Carbanion - their stability - Electrophilic and free radical addition reaction - addition of hydrogen catalysed by Ni, Lindlar's Catalyst, Na/Liq NH3, Wilkinson's Catalyst, halogen, water and hydrogen halide in the presence and absence of perodixe. Oxidation with permanganate (Baeyer's test) hydroboration - oxidation and ozonolysis - reductive and oxidative ozonolysis. Polymerisation - Geiger - Natta Catalyst for polymerisation. Allylic substitution with NBS.

Reference Books for Papers I & II

1. G.F. Liptrot, "Modern Inorganic Chemistry", ELBS.
2. E.S.Gilreath, "Fundamental Concepts of Inorganic Chemistry", McGraw Hill.
3. I.L. Finar, "Organic Chemistry Volume I", ELBS.
4. R.T.Morrison and R.N.Boyd, "Organic Chemistry", Prentice Hall.
5. S.Glasstone and D.Lewis, "Elements of Physical Chemistry", Macmillan.
6. Oelke, "Laboratory Physical Chemistry", Van Nostrand Reinhold.
7. B.R.Puri, L.R.Sharma & M.S.Pathania, “Principles of Physical Chemistry”, Shoban Lal Nagin Chand & Co.

II Semester **Subject Code : 2MC03A**

MAIN PAPER - III

INORGANIC, ORGANIC & PHYSICAL CHEMISTRY - I

Unit - I

Elements of zero group or Rare gases -Position in the periodic table. Electronic configuration. Occurrence, Isolation and separation. Properties - Physical and Chemical. Uses.

Chemistry of Xenon - Fluorides and Oxides – XeF_2, XeF_4, XeF_6, XeO_3, $XeOF_4$ - Preparation, properties and structure. Clathrates of noble gases.

Unit - II

Dienes - Stability of dienes- conjugated, isolated and cumulative - Chemical reactivity - Mechanism of 1,2- and 1,4 - addition - Kinetically and thermodynamically controlled product - Electrophilic and radical addition - Hydroboration, oxidation by permanganate, ozonolysis and addition of water. Diels-Alder reaction. Synthesis of dienes - 1,3 butadiene, isoprene and chloroprene.

Alkynes - Preparation and properties -acidity of alkynes, formation of acetylides, addition of water with $HgSO_4$ catalyst, addition of hydrogen halides and halogens, oxidation, ozonolysis and hydroboration.

Unit - III

Benzene - Reactions of benzene- Electrophilic Substitution with mechanism - Nitration, halogenation, (Nuclear and side chain halogenation) Friedel Craft's alkylation and acylation, sulphonation. Free radical reactions - addition of H_2, Cl_2. Ozonolysis of benzene. Structure of benzene - VB method and MO method - delocalisation of π bonds, Resonance - aromaticity - Huckel's (4n+2) rule and its simple applications- Non benzenoid aromtic compounds.

Unit - IV

Mesomeric effect - delocalisation and resonance - Hyperconjugative effect - steric effect - Orientation by substituents - Ortho - Para (o/p) ratio and explanation.

Alkyl benzene - Free radical substitution at side chain - oxidation.

Polynuclear aromatic hydrocarbons - Naphthalene, Phenanthrene and Anthracene - 2 preparations . Electrophilic substitution reactions . uses. Aromatic character - resonance energy. Structure.

Unit - V

Ideal gas equation. Kinetic theory of gases - Derivation of PV = $1/3Nmc^2$ - Deduction of gas laws. van der Waal's equation - Derivation.

Virial equation of state - with respect to Boyle's temperature only.

Mean free path. Collision diameter. Collision number.

Transport Properties - Thermal conductivity, Viscosity and Diffusion.

Maxwell's distribution of molecular speeds (Qualitative treatment only - no derivation) - mean velocity, root mean square velocity and most probable velocity. Degree of freedom of motion. Coefficient of thermal expansion and compressibility - Definition only.

II Semester **Subject Code : 2MC04A**

MAIN PAPER – IV

INORGANIC, ORGANIC & PHYSICAL CHEMISTRY – II

Unit - I

Alkali metals - Group discussion - Comparison of Hydroxides, Carbonates, Bicarbonates, Oxysalts, Oxides, Peroxides, Hydrides and Halides.

Lithium - Extraction and anamalous behaviour. Diagonal relationship with Magnesim. Lithium aluminiumhydride. Microcosmic salt - Preparation.

Alkaline earth metals - Group discussion - Comparison of Hydroxides, Carbonates, Nitrates, Oxides, Hydrides and Halides.

Beryllium - Extraction and anamalous behaviour. Diagonal relationship with Aluminium. Compounds of Calcium - Calcium carbide and Calcium cyanamide.

Compounds of Barium - Barium chloride, Baryta and Lithopone.

Unit -II

Alkyl halides - Saturated and unsaturated - Chloroform, Carbon tetrachloride, Allyl chloride and Vinyl chloride - Preparation, properties and uses.

Dihalides - Vicinal and gem dihalides - Ethylene and ethylidene halides - Preparation and synthetic uses.

Aromatic halogen compounds - Nuclear and side chain - Preparation and properties.

Unit - III

Alcohols - Oxidation of alcohols. Unsaturated alcohol - Allyl alcohol - Preparation and properties.

Phenols - Acidic nature of phenol and substituted phenols.

Dihydric and trihydric phenols - Catechol, Resorcinol, Quinol, Pyrogallol, Phloroglucinol and Hydroxyquinol - Preparation, properties and uses.

Naphlthols - α - and β - Naphthols - Preparation, properties and uses.

Unit - IV

Vapour pressure –Definition- Measurement of vapour pressure by Isoteniscopic method. Molar heat of vapourisation and Trouton's rule.

Viscosity and Viscosity coefficient- Definition- Units of Viscosity Coefficient. Determination of Viscosity by Ostwald Viscometer. Effect of temperature on Viscosity. The Hole theory.

Surface Tension: Definition- Effect of temperature- Determination of Surface Tension by Stalagmometer. Parachor-Definition.Atomic Parachor and Structural Parachor-Applications of Parachor in deciding structures.

Liquid crystals- Classification- Theory of liquid crystals.

Unit-V

Non aqueous solvents- Classification -General properties of Ionising solvents- Physical properties -Dipole moment, Viscosity , conductance and proton affinity. Chemical properties-Acid Base reactions, solvation reactions, Precipitation reactions and solvolysis.

Liquid ammonia as a solvent-Chemcal reactions, Advantages and disadvantages. Liquid sulphur dioxide as a solvent-Chemical reactions.

Liquid HF as a solvent .

Reference Books for Papers III & IV

1. G.F. Liptrot, "Modern Inorganic Chemistry", ELBS.
2. R.C.Agarwal, "Modern Inorganic Chemistry", Kitab Mahal - Allahabad.
3. I.L.Finar, "Organic Chemistry Volume I", ELBS.
4. R.T. Morrison and R.N. Boyd, "Organic Chemistry", Prentice Hall.
5. S.Glasstone and D.Lewis, "Elements of Physical Chemistry", Macmillan.
6. S.H.Maron and J.B.Lando, "Fundamentals of Physical Chemistry", Macmillan.

III Semester **Subject Code : 3MC05**

MAIN PAPER – V

ANALYTICAL CHEMISTRY

Unit - I

Analytical balance - Principle and care. Sources of errors in weighing – Temperature effects, electrical effects, moisture and absorption effects, air buoyancy, use of uncalibrated weights . Calibration of weights. General rules for weighing. Weighing of solids and liquids. Types of weighing – weighing by difference, direct weighing, accurate and rough weighing. Single Pan balance – Advantages only. Volumetric glassware - Volumetric flasks, Pipettes and Burettes - Care, use and calibration.

Unit - II

Data Analysis - Significant figures and computations. Accuracy and precision. Accuracy – Absolute error and relative error. Precision – Mean deviation, Standard deviation, coefficient of variation and variance. Classification of errors – Determinate errors and Indeterminate errors. Determinate errors – Instrumental Personal, Operative, Methodic, Reagent, Constant and Proportional error. Indeterminate error - Normal distribution. Minimisation of errors – Calibration of apparatus, Running a blank determination, use of independent method of analysis. Confidence limit. Rejection of results – Q test. Comparison of results – Student's t test – t test when an accepted value is known. F test. Least square analysis.

Unit - III

Purification techniques - Sublimation and distillation. Sublimation – Conditions. Techniques – Simple and vacuum sublimation. Distillation – Conditions for Simple, fractional, vacuum, steam and azeotropic distillation. Techniques – Vacuum and steam distillation. Drying agents and desiccants. Drying of solids and liquids. Tests to check the purity : solids – melting point. Liquids – Boiling point.

Separation techniques - Solvent extraction - Distribution ratio and common solvents. Methods of extraction – Batch extraction , continuous

extraction, Soxhlet extraction. Chromatography - Interaction of sample molecules with stationary and mobile phases - Adsorption, partition and

ion exchange. Column Chromatography – Adsorption, Adsorbents, Preparation of column, Development, Elution, Elution profile, Retention volume and applications (detailed discussion not included)TLC – Adsorption, preparation of TLC plate, sample application, development, Rf value, chromogenic agent and one application. Paper chromatography- Partition, Sample application Development (Ascending & Two dimensional), Chromogenic agent, Rf value, Application – separation of aminoacids. Ion exchange chromatography- Ion exchange types of resins (Anion exchanger and Cation exchanger), factors determining the affinity of ion for resin (size of the hydrated ion and charge on the ion). Application – Separation of zinc and magnesium, chloride and bromide. GLC – elementary treatment.

Unit - IV

Primary standards - Characteristics - Examples for acidimetry, alkalimetry, complexiметry and redox titration. Weight percent and molarity of commercial HCl and H2 SO4. Preparation of dilute acids from the commercial sample. Selection of indicators - Acid-base, redox, precipitation and complexometric titrations. Construction of titration curve for acid – base titration only.

Unit - V

Estimation of Glucose, Carboxylic acids, Amines, Phenols, Ketones, Oils and Fats - Principle, general method and calculation. Determination of Iodine value, Saponification value and RM value.

Reference Book for Paper V

1. F.W.Fifield and D.Kealey, "Principles and Practice of Analytical Chemistry", International Text Book Company.
2. Gary D. Christian, "Analytical Chemistry", John Wiley and Sons.
3. Walter E.Harris and B.Kratochvil, "An Introduction to Chemical Analysis", Holt-Saunders.
4. D.A.Skoog and D.M. West, "Fundamentals of Analytical Chemistry", Holt, Rinehart and Winston.
5. J.Bassett, R.C.Denrey, G.H. Jaffery and Mendham, "Vogel's Handbook of Quantitative Inorganic Analysis", ELBS.

III Semester **Subject Code : 3MC06A**

MAIN PAPER –VI

THERMODYNAMICS

Unit – I

First law of thermodynamics - Statement. State function and path functions- Concept of internal (intrinsic) energy and enthalpy. Relation between internal (intrinsic) energy and enthalpy. Heat Capacity – Heat Capacity at constant volume and pressure and their relationship - Isothermal and adiabatic process - Reversible and irreversible transformations. Maximum work. Work done in an isothermal and adiabatic process for an ideal gas and a non ideal gas obeying van der Waal's equation. Joule Thomson effect - Joule Thomson coefficient and inversion temperature.

Unit – II

Law of thermochemistry. Dependence of heat of reaction on temperature - Kirchoff's equation. Bond energies – calculation from thermochemical data. Second law of thermodynamics - Limitations of the first law and need for second law. Various statements of second law Carnot's cycle - Efficiency of heat engine. Carnot's theorem.

Unit – III

Concept of entropy - Mathematical formulation - Entropy change in a cyclic process, reversible and irreversible processes. Clausius inequality. Calculation of entropy changes of an ideal gas with changes in P.V and T. Entropy changes in physical transformation. Entropy of mixing. Entropy change of the universe.Free energy and work function - Conditions for equilibrium and spontaneity.

Unit – IV

Temperature dependence of free energy - Derivation of Gibb's Helmholtz equation. Fundamental equations of thermodynamics - Maxwell's relations and thermodynamic equations of state.

Partial molar properties - Chemical potential - Gibbs - Duhem equation. Effect of temperature and pressure on chemical potential. Chemical potential in systems of ideal gases. Duhem - Margule's equation and application.

Unit – V

Law of Equilibrium - Thermodynamic derivation. Relationship between Kp, Kc and Kx. Free energy and Chemical equilibrium. Standard free energy change and equilibrium constant of a reaction. Degree of advancement of a reaction. Variation of equilibrium constant with temperature- van't Hoff equation - Effect of pressure on equilibrium.Concept of fugacity and activity- Determination of fugacity of a gas. Fugacity in a gaseous mixture. Determination of activity coefficient.

Reference Books For Thermodynamics

1. G.W.Castellan, "Physical Chemistry", Narosa Publishing House
2. S.H. Maron and J.B.Lando, "Fundamentals of Physical Chemistry", Macmillan.
3. B.R.Puri, L.R.Sharma & Madan S.Pathania, “Principles of Physical Chemistry,” Shoban Lal Nagin Chand & Co.
4. P.P. Rastogi and R. R. Misra, “An Introduction to Chemical Thermodynamics”

III Semester **Subject Code :ONC**

NUTRITIONAL CHEMISTRY

Unit – I

MACRONUTRIENTS AND WATER

Macronutrients – Proteins,fats & Carbohydrates – sources & functions.

Unit – II

MICRONUTRIENTS

Fats & Water soluble vitamins – Sources & functions.Minerals – Major – Ca,P,Na,Cl – sources & functions.Minerals – Minor – Fe,Cu,Mn&Zn – Sources & functions.

Unit – III

BALANCED DIET

Balanced diet – definition – Classification of the activities based on Occupation, Requirements for maintaining health. ICMR recommended diet chart.

Unit – IV

NUTRITIONAL DISORDER

Protein Energy Malnutrition, Eye Disorders, Vitamin D deficiency disorders, Iodine deficiency disorders.

Unit – V

COOKING & ITS EFFECTS

Causes of cooking & types of cooking – effects of cooking on vegetables,fruits,milk,egg,fish & meat.

REFERENCE BOOKS :

FOOD & NUTRITION – Dr.SHRINANDAN BANSAL (BMBS)

FOOD SCIENCE - Dr.S.SWAMINATHAN

NUTRITIONAL SCIENCE – Dr.SRILAKSHMI

IV Semester **Subject Code :4MC07A**

MAIN PAPER –VII

INORGANIC CHEMISTRY

Unit- I

Carbon family-Group discussion. Carbides - Definition, types-Ionic, Covalent, metallic carbides. General methods of preparation, properties and Industrial applications. Silicates - Classification and structure. Felspars, Zeolites and Ultramarines – structures and application. Inorganic polymers – Teflon, Silicones – preparation and uses.

Unit -II

Nitrogen family-Group discussion. Hydrazine, Hydraxylamine, Hydrazoic Acid - preparation and properties. Oxides of Nitrogen- N_2O, NO, NO_2 - preparation,properties and structure. Nitrides-Types-Ionic, covalent and metallic nitrides - preparation, properties and applications. Inorganic Polymer - Phosphonitrilic polymers - $(PNCl_2)_3$,&$(PNCl_2)_4$ - preparation, properties & applications. Poly phosphates.

Unit- III

Oxygen family - Group discussion. Oxides, Oxy acids &Halides of S,Se,Te-

preparation, properties and structure.

$Na_2S_2O_3.5H_2O$ - Preparation, properties and uses.

Halogen family - Group discussion. Oxides and oxyacids of halogen-Preparation & structure. Basic properties of Iodine. Polyhalide ions-classification & structure.

Unit -IV

‘ d’ block elements-brief introduction. Titanium, Vanadium, chromium-a comparative account. Titanium-important ores. Extraction from ilemenite , rutile & uses. Important compounds of titanium-halides and oxides – preparation, properties and uses.

Zirconium - important ores - Extraction and uses. Important compounds - Halides and oxides - preparation, properties and uses. Vanadium-important ores-Extraction and uses. Important compounds-Oxides, Halides and oxyhalides - preparation, properties and uses.

Unit -V

Molybdenum-important ores. Extraction, properties and uses. Important compounds-Molybdenum oxides, ammonium Molybdate, molybdenum blues-preparation and uses. Tungsten-important ores-Extraction. Important compounds - oxides, halides, tungstic acid, tungsten bronze. Tantalum : Important ores-extraction and uses.

Reference books for Paper VII

1. Inorganic chemistry – P.L.Soni and O.P.Dharmarha –Sultan Chand & co.
2. Inorganic Chemistry-B.R.Puri and L.R.Sharma-Shobanlal Nagin- Chand & co.
3. Concise inorganic Chemistry-J.D.Lee – ELBS.
4. Advanced inorganic Chemistry-Satya Praksh-S.Chand & co.

IV Semester **Subject Code : 4MC08A**

MAIN PAPER –VIII

ORGANIC CHEMISTRY

Unit-I

Ethers –Cleavage of ethers by acids – Mechanism. Cyclic ethers – Crown ethers –Host –Guest relationship. Epoxide – Preparation – Reactions of Epoxides - Acid catalysed cleavage. Base catalysed cleavage. Orientation of cleavage of epoxides. Phase transfer catalysis. Aliphatic Nucleophilic Substitution reactions – SN1 and SN2 mechanism. Stereochemistry. Effect of structure, leaving group, entering nucleophile and polarity of solvent. Sni Reaction-Mechanism. Neighbouring group participation.

Unit –II

Addition across carbonyl group – Mechanism – Acid catalysed and base catalysed reaction – HCN, RMgX, NH_2OH, NH_2-NH_2, NH_2-NHC_6H_5 and NH_2-$NHCONH_2$. Addition of alcohols and thiols – Acetals, ketals and thioacetals. Addition of carbanions – Aldol, Benzoin and Claisen ester condensation and Perkin's, Knoevenagel, Wittig, Tischenko & Reformatsky reaction – Mechanism only Cannizaro reaction – Mechanism. Halogenation of ketones – Mechanism. Gattermann, Gattermann-Koch, Sommelet, Etard and Stephen's reaction. Vilsmeier and Houben – Hoesch synthesis.(Mechanism not needed). Analytical tests for Aldehydes and Ketones – Tollen's, Fehling's and Haloform tests.

Unit - III

Unsaturated acids – Acrylic, Crotonic and Cinnamic acids – Preparation and properties. General mechanism of conversion of acids into acid derivatives. Hydrolysis of esters-BAC2 and AAC2 mechanism only – Effect of substituents. Steric factor.

Malonic ester, Acetoacetic ester and Cyanoacetic ester – Preparation & Synthetic uses.Characteristic reactions of keto and enol form of Acetoacetic ester.

Unit -IV

Nitro alkane and Alkyl nitrite - Distinction. Primary, secondary and tertiary nitro compounds - Distinction. Reactivity of amines - Alkylation and acylation – Mechanism. Hofmann's exhaustive methylation.

Diazoacetic ester and diazomethane-Preparation and synthetic uses. Amino acids-Glycine,alanine & tryptophan-Preparation and properties. Action of heat on α, β & γ-amino acids.

Unit-V

Elimination - Mechanism - E1& E2- Evidences, reactivity and. Orientation -Hofmann and Saytzeff's rules. Cis and alpha eliminations.Factors affecting elimination reactions- Effect of substituents, nucleophiles and solvent polarity. E2 versus E1. Elimination versus substitution.

Reference Books for Paper VIII

1. I.L.Finar, "Organic Chemistry Volume I", ELBS.
2. R.T. Morrison and R.N. Boyd, "Organic Chemistry", Prentice Hall.
3. Peter Sykes, "Mechanism in Organic Chemistry",Orient Longman.
4. Parmer and Chawla,Reaction Mechanism in Organic Chemistry", Sultan Chand & Sons.

IV Semester **Subject Code : 4MC09A**

MAIN PAPER – IX

PHYSICAL CHEMISTRY

Unit-I

Solutions of Schrodinger Wave Equation for some simple systems- Particle in one Dimensional Box and Particle in three Dimensional Box; Wave Mechanical treatment- VBT- Formation of H_2 Molecule; MOT- Formation of H_2^+

Unit-II

Introduction- Radioactivity-Properties of α, β and γ rays; Theory of Radioactive Disintegration; Soddy-Fajan's Group Displacement Law; Rate of Radioactive Decay; Radioactive Equilibrium; Radioactive Series; Mass defect' Packing Fraction and Nuclear Binding Energy; Artificial Disintegration of atoms; Artificial Radioactivity; Cyclotron; Radiation Dosimetry- Dosimeters; Genetic effects of Radiation; Radiation Protection; Applications of Radioactivity.

Unit-III

Clapeyron-Clausius equation-Derivativation and Applications; Nernst Heat

Theorem; Third Law of Thermodynamics - Evaluation of Absolute Entropy from Heat Capacity Measurement. Distribution law- Distribution coefficient, conditions for the validity of the distribution law and Thermodynamic derivation. Association of the solute in one of the solvents. Dissociation of the solute in one of the solvents. The solute enters into chemical combination with one of the solvents. Applications of distribution law- study of association of a solute, study of dissociation of a solute, distribution indicators, study of complex ions and solvent extractions

Unit-IV

Binary liquid systems –Binary liquid mixtures- concentration units – Molarity, Molality, Normality and Mole fraction. Raoult's law Ideal solution- Thermodynamics of ideal solution ΔGmix, ΔVmix, ΔHmix, ΔSmix. Vapour pressure and ideal solutions. Deviation from ideal behaviour-Vapour pressure- composition curves and Temperature-composition curves. Fractional distillation of binary liquid solutions and Azeotropic distillation. Partially miscible liquid pairs-Phenol-Water and Nicotine- Water. Effect of impurities on CST. Immiscible liquids- Theory and applications of steam distillation.

Unit-V

Electric Properties: Dipole moment-Electrical Polarisation; Molar Polarisation and Dielectric constant; Clasius-Mosotti Equation; Debye Equation; Determination of Dielectric constant and Dipole moment; Bond Moments; Dipole Moment and Molecular Structure. Magnetic Properties: Magnetic Permeability, Diamagnetism; Paramagnetism; Magnetic Susceptibility- Measurement of Magnetic Susceptibility; Ferromagnetism and Antiferro magnetism.

Reference Books For Paper IX

1. S. Glasstone, "Source Book On Atomic Energy", East – West Press, PVT LTD.
2. P.W. Atkins, "Physical Chemistry" Oxford University Press.
3. David.P. Shoemaker, Carl W. Garland and Joseph W.Nibler, "Experiments in Physical Chemistry". McGraw Hill .
4. Samuel Glasstone and David Lewis, "Elements of Physical Chemistry". McMillan.
5. B.R.Puri, L.R. Sharma and Madan .S. Pathania, " Principles of Physical Chemistry". Shoban Lal Nagin Chand and Co.

V Semester **Subject code-5MC10A**

MAIN PAPER-X

CO-ORDINATION CHEMISTRY

Unit- I

A brief introduction about ligands,co-ordination number,co-ordination sphere and complex ion. Nomenclature of co-ordination compounds-simple and bridged Compounds. Optical isomerism exhibited by 4&6 co-ordination complexes. Theory of bonding in complexes-Sidgwick's theory,valence bond theory - Explanation of geometry and magnetic properties of 4 & 6 coordinated
complexes. Limitations of valence bond theory.

Unit- II

Crystal field theory-A brief introduction. Crystal field splitting of 'd' orbitals in octahedral,tetrahedral and square planar complexes. Factors influencing the magnitude of delta. Stronger and weaker ligands and spectrochemical series. Distortion of octahedral complex-Jahn Teller theorem. Condition for slight distortion and strong distortion. Cause of distortion with some examples.

Unit- III

Explanation of magnetic properties and colour of complexes. Crystal field stabilization energies & their uses-crystal structure of spinels, stabilization of oxidation states. Stability of complexes in solution - Thermodynamic stability,Kinetic stability. Kinetic vs thermodynamic stability. Limitatations of crystal field theory. Comparison of valence bond and crystal field theories.

Unit- IV

Metal carbonyls- A brief introduction-preparation,properties and structure of Mono and binuclear carbonyls. Synthesis,important reactions and structure of (i)Nickel tetra carbonyl (ii)Iron penta carbonyl

(iii)Iron ennea carbonyl (iv)Dicobalt octa carbonyl (v)Dimanganese decca carbonyl Hetronuclear carbonyls – Definition and examples only.

Unit- V

Applications of coordination chemistry – Application in quantitative & qualitative analysis. Sequestration- Definition and examples for sequestering agents. EDTA-Structure and applications. Metal complexes in biological system –haemoglobin and chlorophyll.

Reference books for Paper X

1. Selected topics in inorganic chemistry – Whahid.U.Malik,G.D.Tuli & R.D.Madan – S.Chand & co.
2. Modern inorganic chemistry - R.D. Madan – S.Chand & co.
3. Inorganic chemistry – B.R.Puri and L.R.Sharma - S.Chand & co.
4. Advanced inorganic chemistry – F.Albert Cotton and Geoffrey Wilkinson – A Wiley- interscience publications.

V-Semester **Subject Code:5MC11**

MAIN PAPER – XI

STEREOCHEMISTRY AND NATURAL PRODUCTS

Unit - I

Optical Isomerism - Chiral centre. Elements of symmetry – Plane, centre, axis and alternating axis of symmetry. Enantiomers and diastereomers – A brief explanation. DL and RS nomenclature. Racemisation – through keto enol tautomerism, by dehydrogenation of secondary alcohols and through the formation of carbonium ion. Resolution – Conversion into diastereoisomers, kinetic, chromatographic and biochemical method. Asymmetric synthesis – Definition. Partial asymmetric synthesis – two examples. Absolute asymmetric synthesis - One example. Walden inversion – Brief explanation. Allenes, Spiranes and Biphenyls - Optical activity.

Unit - II

Geometrical Isomerism - E-Z system of nomenclature. Maleic and Fumaric acids - Methods of assigning configuration - By action of heat and method of formation of solid solution. Conformational analysis - Conformers of ethane, propane, n-butane, dichloroethane, cyclohexane, mono and disubstituted cyclohexane. 1,2 - and 1,3 - interactions. Decalin - A brief note.

Unit - III

Carbohydrates - Definition and classification. Monosaccharides - Reaction of glucose and fructose – Periodic acid oxidaton, Osazone formation, mutarotation and epimerisation. Conversion of aldose into ketose – One method. Conversion of Ketose into aldose -One method. Conversion of pentose into hexose – Kiliani's synthesis. Conversion of Hexose into pentose – Wohl's and Ruff's method. Structural elucidation of glucose and fructose. Distinction between ribose and 2 - deoxyribose.

Unit – IV

Disaccharides - Structural elucidation of sucrose and maltose. Polysaccharides -Structure of starch and cellulose (an elementary treatment). Derivatives of cellulose - Cellulose nitrate and cellulose acetate - Applications.

Unit - V

Proteins - Classification, Colour reactions and denaturation of proteins. Structure of proteins - Primary, secondary and tertiary structure. Functions of proteins. Nucleic acids - DNA and RNA - Their components. Biological functions - Replication and Protein synthesis (Elementary treatment only).

Reference Books for Paper XI

1. I.L. Finar, "Organic Chemistry Volume I", ELBS
2. I.L. Finar, "Organic Chemistry Volume II", ELBS
3. R.T. Morrison and R.N. Boyd, "Organic Chemistry", Prentice Hall.
4. Peter Sykes, "A Guide Book to Mechanism in Organic Chemistry", Orient Longmans.
5. E.L. Eliel, "Stereochemistry of Carbon Compounds", Tata-McGraw Hill.

V Semester **Subject Code : 5MC12**

MAIN PAPER - XII

ELECTROCHEMISTRY

Unit - I

Conductance - Metallic and electrolytic conductance –Measurement of Cell constant, Specific conductance, Equivalent, conductance and Molar conductance. Variation of conductance with concentration - Weak and strong electrolytes. Theory of strong electrolytes. Debye - Huckel - Onsagar theory. Verification of Onsagar equation - Wien effect - Falkenhagen effect. Mobilities and velocities of ions - Determination by Kohlrausch's law and explanation for the high mobilities of hydrogen and hydroxyl ions. Transport number - Determination by Hittorf and moving boundary method. Applications of conductance measurements - Determination of ionic product of water, degree of dissociation of weak electrolyte and solubility of sparingly soluble salts. Conductometric titrations - Theory of acid - base and precipitation titrations - Advantages and Limitations.

Unit - II

Acids and bases - Ionisation constants of weak acids and bases - Determination. Buffer Solutions - pH and pOH, mechanism of buffer action, buffer capacity and selection of a buffer. Hydrolysis of salts - Determination of hydrolytic constant and degree of hydrolysis of salts - weak acids and strong bases, strong acids and weak bases and weak acids and weak bases.

Unit - III

Reversible and irreversible cells - Electromotive force and its measurement. Weston standard cell - Construction and working. Cell reactions and emf - Conventions regarding sign of emf. Reference electrodes - Single electrode potentials - Determination of single and standard electrode potentials. Electromotive series - Applications.

Thermodynamics of electrochemical reactions - Relation between emf data and thermodynamic quantities. Thermodynamics of electrode potentials - Nernst equation and its application. Classification of electrodes - Metal / Metal ion electrodes, amalgam electrodes, gas electrodes and metal / insoluble salt electrodes - Nernst equation for each electrode.

Unit - IV

Classification of electrochemical cells - Chemical cells with and without transference & Concentration cells – Electrode concentration cell without transference and electrolyte concentration cell with transference - Derivation of the expression for emf. Liquid junction potential - Determination and elimination. Applications of emf measurements - Determination of the solubility product of sparingly soluble salts – one method, pH of buffer solutions and pKa of weak acids. Potentiometric titrations - Acid - base, redox and precipitation titrations - Advantages.

Unit - V

Practical Cells - Dry cell and lead storage battery. Electrolysis - Decomposition potential - Determination and calculation of reversible decomposition potential.

Polarisation - Types - Concentration polarisation and overvoltage - determination. Electrodeposition of metals - Importance of hydrogen overvoltage. Corrosion - Electrochemical theory, effect and prevention.

Reference Books for Paper XII

1. S. H. Maron and J.B. Lando, "Fundamentals of Physical Chemistry", Macmilllan.
2. S. Glasstone and D. Lewis, "Elements of Physical Chemistry", Macmillan.
3. P.D. Groves, "Electrochemistry", John Murrey.
4. S. Glasstone, "An Introduction to Electrochemistry", East West Press.

V Semester **Subject Code:5MC13**

MAIN PAPER – XIII

INSTRUMENTAL METHODS OF ANALYSIS

Unit - I

Colourimetric Analysis:Lambert-Beer's Law-Validity and applications. Methods of colour measurement-Standard series method, Duboscq colourimeter, Photoelectric colourimeter, Spectrophotometric method .Criteria for satisfactory Colourimetric Estimations.Advantages of colourimetric Analysis.Colourimetric estimations of Selected ions. Determination of composition of complexes-Job's continuous variation Method. Fast reactions - Flow method & Relaxation method. Photochemical method-Actinometry Flash photolysis & Pulse radiolysis

Unit - II

Thermogravimetric analysis – Principles – TG and DTG thermograms (Eg) CaC2O4. H2O and CuSO4 5H2.O. Factors affecting TG results- Heating rate, furnace atmosphere, crucible geometry and sample characteristics. Apparatus - The Thermal balance, criteria for good thermal balance. Applications. Differential thermal analysis - General principles - Sources of differential thermogram peaks and peak areas., differential Thermogram of CaC2 O4. H2O in N2 and O2 atmosphere. Instrumentation. Applications. Thermometric titrations – Principles and conditions. Thermometric titration curve (Eg). Boric acid Vs NaOH. Apparatus and advantages.

Unit - III

Electrolytic seperations - Principles of electrodeposition - Experimental variables that influence the nature of a deposit – Gas evolution, current density, stirring, temperature and chemical variables – Effects of pH, effect of complexing agents. Electrogravimetry – Constant current method and controlled electrode potential method – Principle and instrumentation. Estimation of Copper and Silver.

Unit - IV

Basic principles - Migration, convection and diffusion current. Experimental assesmbly. Current - Voltage curve and oxygen waves. Dropping mercury electrode - Advantages and disadvantages. Ilkovic equation (No derivation) and significance. Polarography as an analytical tool in qualitative and quantitative analysis. Amperometry - Basic principles. Typical titration curves (Eg) lead Vs sulphate, sulpate Vs lead and lead Vs. chromate. Apparatus and advantages.

Unit -V

Basic Principles – Instrumentation – Aston's and Dempster's mass spectrograph. Molecular mass spectra -Characteristics and interpretation - Base peak, parent peak, isotope peak and metastable peak. General rules for fragmentation and identification – Nitrogen rule, Mc- Lafferty rearrangement. Determination of molecular formula – Any two simple examples.

Applications – General.

Reference Books for Paper XIII

1. G.W. Ewing, "Instrumental Methods of Chemical Analysis", McGraw Hill.
2. D.A. Skoog and D.M. West, "Principles of Instrumental Analysis", Holt Saunders.
3. S. Glasstone and D. Lewis, "Elements of Physical Chemistry", Macmillan.
4. D.P.Shoemaker and C.W. Garland, "Experiments in Physical Chemistry", McGraw Hill.

V Semester **Subject Code : 5EC01**

APPLICATION ORIENTED SUBJECT

INDUSTRIAL CHEMISTRY-I

Unit I

Definition of paper and pulp- manufacture of pulp - mechanical process, sulphate process & sulphite process . A brief note on rag pulp. Beating , filling, sizing, colouring, various steps involved in the manufacture of paper from the pulp by Fourdrinier machine & calendaring .Manufacture of heavy paper by using cylindrical machine- types of paper & their uses.

Unit II

Cement- meaning - Portland cement - types of Portland cement manufacture of cement - setting of cement , factors considered in quality testing of cement. Uses of cement - brief note on concrete. Refractories- meaning - refractoriness , spalling , fusion point , brief note on fireclay bricks, silica bricks & dolomite bricks.

Unit III

Varnishes- meaning; two types-spirit varnish & oleo resinous varnish . Constituents of varnishes - resins, drying oil, solvents , thinners, driers,antiskinning agents & plasticizers - uses of varnishes . Special types of varnishes-Japans, Enamels. Lacquers- meaning- constituents - cellulose derivatives , resins & plasticizers. Solvent uses of lacquers- a brief note on pigment lacquers .

Unit IV

Dye - definition - requirement of a dye . Chromophore - auxochromes , witt"s theory of colour & constitution. Batho chromic shift hypso chromic shift - classification of dyes - based on application - direct dye, acid dye, basic dye, mordant dye, vat dye, ingrain dye& reactive dyes. Classification based on structure- Azo dyes - aniline yellow, methyl orange, para red , congo red, Bismarck brown. Triphenyl methane dyes -

malachite green, Rosaniline. Indigoid dyes - indigo. Anthraquinone dye - alizarin.

Unit V

Pigments-meaning, characteristic of a good pigment .White Pigments - zinc oxide-manufature by French process. Titanium di oxide-maufacture by modern chlorine method . Blue Pigments-ultra marine blue - manufacture by soda process. Green Pigments - chromium oxide - preparation from chromite ore. Uses of the above pigments.Fluorescent brighteners - a brief note.

Reference Books For Industrial Chemistry -I

1. Dr.B.K.Sharma, "Industrial Chemistry," Goel Publishing House.
2. Dr.M.Karunanidhi, Dr.N.Ayyaswami, Dr.T Ramachandran & Dr.H.Venkatraman, "Applied Chemistry," Educational Publishers.
3. James A Kent, "Riegels Hand Book Of Industrial Chemistry," Van Nostrand Reinhold Company.
4. Gurdeep.R.Chatwal, "Synthetic Organic Chemistry," Himalaya Publishing House.
5. George T.Austin, "Shreve's Chemical Process Industries," McGraw-Hill.
6. Dr.O.D.Tyagi & Dr.M.Yadav, "A Text Book Of Synthetic Dyes," Anmol Publications.

V Semester **Subject Code : 5EC02**

APPLICATION ORIENTED SUBJECT

PHARMACEUTICAL CHEMISTRY

Unit - I

Important terminologies - Drug - Pharmacokinetics, Pharmacodynamics, Pharmacophore - metabolite - antimetabolite. LD50 CD50. Therapeutic index - Source of drugs. Active principle. Names of drugs. Code number - Chemical proprietary, trivial, trade and non-proprietary names. Synonyms. Storage of drugs. Sustained release of drugs. Absorption and distribution of drugs. Metabolism of drugs and their effect on Pharmacological activity. Drug designing. Drug interactions.Indian medicinal plants - tulsi, neem, fig, kizhanelli. semparuthi, adadodai & thoothuvalai.

Unit--II

Gram positive and Gram negative bacteria. Definition of antibiotics. Uses of Chloramphenicol, Ampicillins, Streptomycin and Tetracyclins - SAR - Two examples of macrolides. Erythromycin - Uses. Ansamycins - Rifampicin - Adverse reactions - Mechanism of action. Sulphonamides - Sulphanilamide derivatives - General properties and drug action. Preparation and uses of Sulphapyridine, Sulphadiazine, Sulphathiazole, Sulphafurazole and prontosil. Trimethoprim.

Unit - III

Antineoplastic drugs - Causes of cancer and types of cancer. Antineoplastic agents - Cytotoxic agents, antimetabolites, plant products, harmones and antibiotics. Miscellaneous drugs - Hydroxy Urea - mitotane - procarbazine, asparaginase. Antiseptics - Disinfectants. Definition. Standardisation - Phenol Coefficient. Use of phenols, dyes, organo mercurials. Chlorine Compounds - Chlorazodine, Chlorhexidine, Chloramines, Dequalinium Chloride, Cationic surfactants, Nitrofurazone and Formaldehyde.

Unit - IV

Classsification - Narcotic analgesics and antipyretic analgesics. Narcotic analgesics - Mechanism of action Morphine and derivatives. Semisynthetic analgesics. Morphine Congeners - Pethidine and methadone. Synthetic analgesics (NSAID) - Salicylic acid derivative - Salols, indolyl derivatives, anthranilic acid derivatives propanoic acids, para aminophenol derivatives and pyrazolone derivatives. Psychedelic drugs and tranquilisers. Drug abuse and rehabilitation.

Unit - V

Definition - Classification - Uses of volatile liquids as inhalation anaesthetics. Halocarbons and halocarbon ethers. Gaseous anaesthetic agents - Nitrous Oxide and cyclopropane. Intravenous anaesthetic agents. Thiopentol Sodium, methohexitol. Propanidid and ketelar. Local anaesthetic agents - Requisites. Types - Natural and synthetic. Cocaine, Benzocaine, Procaine, Amethocaine, Xylocaine and Cinchocaine. Sedatives and anticonvulsants. Barbiturates. Hydantoins. Oxazolidine diones and succinimides.

Reference Books For Pharmaceutical Chemistry.

1. L. Finar, "Organic Chemistry, Volume II", ELBS.
2. O.P. Agarwal & R.C. Agarwal, "Text Book of Bio-Chemistry", Noel Publishing House.
3. G.R. Chatwal, "Synthetic Drugs", Himalayan Publishing House.
4. G.R. Chatwal, "Synthetic Organic Chemistry", Himalayan Publishing House.
5. Bentley & Drivers, "Text Book of Pharmaceutical Chemistry".
6. Satoskar, "Book of Pharmacology and Indian Pharmocopoea".

VI Semester **Subject code-6MC14**

MAIN PAPER- XIV

ADVANCED INORGANIC CHEMISTRY

Unit- I

Lanthanides and actinides – A brief introduction. Lanthanides - Extraction from monazite. Seperation techniques - Fractional precipitation, Fractional crystallization, Complex formation, solvent extraction, valency change and Ion exchange methods. Chemical properties, colour and spectra, magnetic properties. Actinides-Synthesis. Thorium and uranium - Extraction and chemical properties. Compounds of Thorium - Halide, sulphate and nitrate - preparation and uses. Compounds of Uranium – Uranium hydride, Uraniumdioxide, Uranium hexafluoride, Uraniumtrioxide, Uranium hexachloride, Uranium pentafluoride, Uraniumtetrachloride. Uranates and Uranyl Salts.

Unit- II

Solid state-packing of atoms in metals-BCC, CCP, HCP. Metallic Bond-Electron gas,Pauling and Band theories. Bragg spectrometric rotating crystal and Debye scherrer powder methods. Applications to the structures of –NaCl, LiCl, CaF_2, ZnS, TiO_2, CaC_2 And CdI_2. Conduction in Ionic solids.

Unit- III

Organometallic compounds-Introduction,Classification. Organo Lithium and organo Boron compounds - synthesis and properties.Elements of symmetry, symmetry operations and point groups. Point symmetry and symmetry operations for the following molecules-BF_3, H_2O, F_2O, Trans N_2F_2,NH_3, PCl_3, $Pt(CN)_4^{2-}$,$Ni(CO)_4$, C_6H_6, SF_6, HCl, H_2 & CO_2 .

Unit- IV

Alloys-Introduction, The effect of alloying-Melting point, Physical properties,Thermal and electrical conductivity,Corrodability. Types of alloys –Substitutional,Interstitial & Intermetallic compounds.Hume Rothery rules-Rules for the formation of alloys - size factor & Valency factor. Composition and uses of the following alloys-chrome steel, Manganese steel, Invar, Stellite, cochrome, Monel metal and German silver.

Unit -V

Chemistry of Iron, Cobaltand Platinum. Iron - Biologically important compounds - Myoglobin, cytochrome and ferritin. Cobalt-Extraction, properties and uses. Compounds of cobalt - Cobalt(II)chloride, cobalt(II)nitrate, Cobalt zincate, Cobalt aluminate - Preparation and uses. Platinum - Extraction, Properties and uses. Various forms of Platinum. Compounds of Platinum -monoxide, dioxide, platinic chloride-properties and Uses.

Complexes of Iron, Cobalt and Platinum. Iron-Potassium ferro cyanide, Potassium ferri cyanide, Prussian blue, Sodium nitro prusside. Preparation and uses. Cobalt- Sodium hexa nitro cobaltate,Hexammine cobalt(III)chloride-

Preparation and uses. Platinum-Barium platinocyanide,Potassium platino cyanide,chloro platinic acid-Preparation and uses.

Reference Books For Paper XIV

1. Inorganic Chemistry – B.R.Puri and L.R.Sharma – S.Chand & co.
2. Chemistry of rare elements–H.D.Mathur and O.P.Tandon.S.Chand&co
3. Advanced inorganic Chemistry-Satya Prakash.S.Chand & Co.

VI Semester **Subject Code:6MC15**

MAIN PAPER XV

ADVANCED ORGANIC CHEMISTRY

Unit – I

Heterocyclic compounds-Aromaticity.

Furan, Thiophene and Pyrrole-Preparation, Properties and Structure. Pyridine-Synthesis, Reactions and Basicity.

Indole, Quinoline and Isoquinoline –Synthesis and Reactions.

Unit - II

Molecular Rearrangements-Classification-Anionotropic,Cationotropic, Free radical, Intermolecularand Intramolecular.

Pinacol - pinacolone, Beckmann, Hofmann, Curtius, Benzil-Benzilic acid and Fries Rearrangements - Mechanism only.

Pericyclic Reactions-Definition and Classification.Caisen Rearrangement-Mechanism only.

Unit - III

Alkaloids - Definition, Extraction and general properties. Classification of alkaloids. General methods of determining structure.

Coniine, Piperine and Nicotine - Structural elucidation.

Unit - IV

Vitamins-Classification- Structural elucidation of Vitamin A and Vitamin C. Enzymes.Coenzymes. Metabolism of glucose.

Unit - V

Terpenoids –Introduction, Isoprene rule, Special isoprene rule and Gem-dialkyl rule. Classification and isolation.

Citral, α- Terpineol, α - Pinene and Camphor - Structural elucildation .

Reference Books for Paper XV

1. I.L.Finar, "Organic Chemistry Volume I", ELBS.
2. I.L.Finar, "Organic Chemistry Volume II", ELBS.
3. R.T. Morrison and R.N. Boyd, "Organic Chemistry", Prentice Hall.
4. Peter Sykes, "A Guide Book to Mechanism in Organic Chemistry", Orient Longmans.
5. E.L. Eliel, "Stereochemistry of Carbon Compounds", Tata-McGraw Hill

VI Semester **Subject Code : 6MC16**

MAIN PAPER - XVI

CHEMICAL KINETICS AND PHASE RULE

Unit - I

Rate of reaction - Average and instantaneous rates. Order and molecularity. Rate laws. Rate constants and their units. Methods of determination of rate of a reaction . Zero, first, second and third order reaction - Derivation of rate constant and characteristics. Derivation of time for half change with examples. Methods of determining the order of a reaction. Experimental methods of studying kinetics - Volumetry, manometry, polarimetry, colourimetry and dilatometry. Effect of temperature on reaction rates - Arrhenius parameters and their calculation.

Unit - II

Collision Theory - Derivation of rate constant of a bimolecular reaction - Failure of the theory. Lindemann's Theory for unimolecular reaction. Theory of Absolute Reaction Rates - Derivation of the rate constant for a bimolecular reaction. Significance of entropy and free energy of activation. Comparison of Collision Theory and ARRT. Complex reaction of first order kinetics - Consecutive, parallel and reversible reactions - Example only (No derivation).

Unit - III

Homogeneous catalysis - Catalysis by Enzymes - Michaelis' Menten mechanism.

Michaelis' constant - Significance and determination. Heterogeneous catalysis - Adsorption - Types - Chemical and physical. Characteristics of adsorption. Different types of isotherms - Freundlich and Langmuir. B.E.T theory of multilayer adsorption.

Unit - IV

Grotthus - Draper law. Law of Photochemical Equivalence - Quantum yield and its determination. Primary and secondary processes - Hydrogen - Chlorine and Hydrogen - Bromine reaction. Photolysis of aldehydes and ketones (no derivation) - Photosensitisation. Fluorescence, Phosphorescence and Chemiluminescence.

Unit - V

Definition of the terms phase, component and degrees of freedom. Derivation of phase rule. One component system - Water, Sulphur and Carbon dioxide. Supercooling and sublimation. Two component system - Solid - liquid equilibria. Simple eutectic - Thermal analysis in the construction of phase diagram. Compound formation with congruent and incongruent melting point. Solid solutions - completely miscible systems. Freezing mixtures and fractional crystallisation - Theory and applications.

Reference Books for Paper XVI

1. K.J. Laidler, "Chemical Kinetics", Tata - McGraw Hill.
2. B. Stevens, "Chemical Kinetics", Chapmann and Hill Ltd.
3. G.W. Castellan, "Physical Chemistry", Narosa Publishing House.
4. S. Glasstone and D. Lewis, "Elements of Physical Chemistry", Macmillan.
5. F. Daniels and R.A. Alberty, "Physical Chemistry", John Wiley and Sons

VI Semester **Subject Code:6MC17**

MAIN PAPER – XVII

SPECTROSCOPY

Unit - I

Introduction. Types of stretching and bending vibrations Eg. H2O and CO2. Simple Harmonic Oscillator - Fundamental vibrational frequency and selection rules. Anharmonic Oscillator - Overtones, combination, difference and hot bands. Group frequency region - Characteristic group frequencies and characterization of molecular structure Eg. Thioacetic acid. Factors influencing vibrational frequencies – inductive effect, mesomeric effect, angle strain, hydrogen bonding and field effects. Calculation of force constant from vibrational frequency and vice versa. Finger print region. Instrumentation – Single beam and double beam IR spectrometer - Block diagram - Source, monochromator, cell, sampling techniques, detectors and recorders. (working of double beam IR spectrometer) Applications - Study of hydrogen bonding, metal carbonyls Eg Mn2 (CO)10, Co2 (CO)8, complexes and progress of reaction.

Unit - II

Scattering phenomenon - Rayleigh and Raman scattering. Selection rules. Raman shift - Stokes and antistokes lines. Mutual exclusion rule - Difference between IR and Raman spectroscopy. Raman spectrophotometer - Components and their function. Advantages of using laser in Raman spectroscopy. Applications - Structural elucidation, study of inorganic and organic compounds and determination of Ka of a weak acid.

Unit - III

Introduction and Franck - Condon principle. Polyatomic organic molecules - Relative energies of orbitals and possible transition between them - Chromophore and auxochrome. Effect of conjugation, auxochrome and solvents on the λ max and intensity of absorption – Bathochromic and hypsochromic shift, hyperchromic and hyprochromic

effect. Woodward and Fieser rules. Calculation of λmax for conjugated polyenes, conjugated aldehydes and ketones.

UV and Visible spectrophotometer - single and double beam Spectrophotmeter – Block diagram, Components and their function. Applications of UV-Visible spectroscopy.

Unit - IV

Nuclear spin angular momentum - Magnitude and Orientation of the components. Splitting of the nuclear spin states and their energies. Relative population of the spinning nuclei in the component states. Gyromagnetic ratio and nuclear spin precessional frequency. Method of excitation and the problem of saturation - Relaxation methods. NMR Spectrometer - Components and their function. Scanning of the NMR spectrum. Chemical shift and coupling constant, J. Elucidation of molecular structure w.r.t. types of protons, number of protons in each type and their chemical environment.

Unit - V

Electron spin angular momentum - Magnitude and Orientation of the components. Splitting of the electron spin states and their energies. Relative population of the spinning electron in the component states. Lande' splitting factor.

ESR Spectrometer - Components and their function.

ESR Spectrum and its interpretation on the basis of molecular structure.

Reference Books for Paper XVII

1. D.A. Skoog and D.M. West, "Principles of Instrumental Analysis", Holt Saunders.
2. Walter J. More, "Basic Physical Chemistry", Prentice Hall.
3. F.W. Fifield and D. Kealey "Principles and Practice of Analytical Chemistry", International Text Book Company.
4. William Kemp, "Organic Spectroscopy", ELBS.
5. Eugene D.Olsen, "Modern Optical Methods of Analysis", McGraw Hill.

VI Semester **Subject Code : 6EC03**

APPLICATION ORIENTED SUBJECT

INDUSTRIAL CHEMISTRY-I

Unit- I

Insecticides-definition, classification -Stomach insecticides contact insecticides, fumigants, attractants & repellants. A brief note & two examples each of the above types .Inorganic insecticides - two examples & uses.Organo phosphorus insecticides - one example - parathion. Herbicides-definition, classification according to the mode of action - Plant sex killers, growth inhibitors, plant growth regulators-a brief note.Selective & non selective herbicides - one example each.Fungicides - meaning - two examples - baygon and zineb.

Unit- II

Edible oils- classification - vegetable & animal oils.Vegetable oil- soya bean oil, corn oil, coconut oil, castor oil & tung oil-method of prepartion.processing of oils- refining , hydrogenation and bleaching . Animal oil - cod liver oil, fish oil - One method of preparation & use. Food processing-milling, canning, freezing, drying, pasteurization & sterilization. Food additives - preservatives, antioxidants, chelating agent, colouring , flavouring and sweetning agents.

Unit- III

Adhesives - meaning -factors affecting adhesives action -classification of adhesives -based on composition of the principal components; based on naturally occurring materials, based on synthetic materials, based on mechanism of adhesion. Solvent responsive adhesives, heat sealing adhesives, pressure sensitive adhesives & chemically reactive adhesives. A brief note on protein adhesives, rubber adhesives, cellulose adhesives & synthetic resin adhesives & their uses .

Unit IV

Polymers - definition - classification - natural & sythentic polymers . Types of polymerisation - addition, condensation & co-polymerisation. Meaning with one example. Degree of polymerisation & molecular weight of a polymer-weight average molecular weight, number average molecular weight, determination of molecular weight-osmotic pressure method. high polymers -physical properties, rubber-natural & synthetic rubber - neoprene, Buna -S, Buna - N, Thiokol & butyl rubber-one method of preparation & application; vulcanization of rubber & additives used in rubber manufacture.

Unit V

Polythene , polyvinyl chloride - one method of preparation & uses. Polypropylene , polystyrene,Teflon -preparation & uses. Fibres-Nylon, nylon-6 & nylon 6,6-preparation and uses. Rayon-brief description,manufature by viscose method,properties & uses. Terylene - manufacture & uses .Plastics & resins - polyvinyl plastics, thermo & thermo setting plastics,Celluloid - preparation & uses. Resins-phenol formaldehyde,urea formaldehyde & silicone resins - preparation, properties & uses .

Reference Books For Industrial Chemistry -II

1. Dr.B.K.Sharma, " Industrial Chemistry," Goel Publishing House.
2. Dr.M.Karunanidhi, Dr.N.Ayyaswami, Dr.T Ramachandran & Dr.H.Venkatraman," Applied Chemistry," Educational Publishers.
3. James A Kent, "Riegels Hand Book Of Industrial Chemistry," Van Nostrand Reinhold Company.
4. Gurdeep.R.Chatwal,"Synthetic Organic Chemistry," Himalaya Publishing House.
5. George T.Austin, "Shreve's Chemical Process Industries," McGraw-Hill. Dr.O.D.Tyagi & Dr.M.Yadav, "A Text Book Of Synthetic Dyes," Anmol Publications.i

PRACTICAL - I

INORGANIC QUALITATIVE ANALYSIS AND PREPARATIONS

1. **Reactions of Cations :** Silver, mercury, lead, copper, bismuth, cadmium, antimony, tin, iron, aluminium, chromium, zinc, manganese, cobalt, nickel, calcium, strontium, barium, ammonium and magnesium.

2. **Reactions of Anions:** Bromide, carbonate, chloride, iodide, nitrate, sulphate and sulphide. Borate, chromate, fluoride, oxalate and phosphate.

3. **Analysis of a mixture** containing two cations and two anions of which one will be an interfering ion-Semimicro technique.

4. **Preparation of the following compounds :**

   i. Ferrous ammonium sulphate
   ii. Potassium trioxalatochromate (III)
   iii. Tetramminecopper (II) sulphate
   iv. Microcosmic salt

PRACTICAL - II

VOLUMETRIC ANALYSIS

1. Aqueous Acid - Base Titrations (Acidimetry and Alkalimetry) :

i. Estimation of sodium hydroxide.

ii. Determination of the strength of a commercially available acid.

iii. Estimation of carbonate and hydrogen carbonate in a mixture.

iv. Estimation of oxalic acid.

v. Estimation of borax.

2. Complexation Titrations:

i. Estimation of calcium using EDTA.

ii. Estimation of hardness of water.

iii. Estimation of zinc.

3. Oxidation - Reduction Titrations :

1. Oxidation with Potassium Permanganate

i. Estimation of iron (II)

ii. Estimation of hydrogen peroxide

iii. Estimation of nitrite

2. Oxidation with Potassium Dichromate

Estimation of iron (II) using external and internal indicators.

3. Oxidation and Reduction Processes Involving Iodine

i. Estimation of copper

ii. Estimation of arsenious oxide

PRACTICAL - III

ORGANIC ANALYSIS AND PREPARATIONS

Organic Analysis : Detection of Nitrogen, Sulphur and Chlorine. Tests for aliphatic and aromatic nature. Tests for unsaturation. Reaction of functional groups. Analysis of unknowns with one functional group and confirmation by the preparation of solid derivatives. Aldehyde, Ketone, Phenol, Primary amine, Monamide, Diamide, Mono and dicarboxylic acids, Ester, Nitro compound, Carbohydrate (reducing & non-reducing).

Organic Preparations: Preparations involving acetylation, diazotisation, halogenation, hydrolysis, nitration and oxidation.

PRACTICAL - IV

GRAVIMETRIC ANALYSIS

i. Determination of water of hydration in crystalline Barium Chloride.

ii. Estimation of Barium as Sulphate.

iii. Estimation of Barium as Chromate.

iv. Estimation of Calcium as Oxalate monohydrate.

v. Estimation of Chloride as Silver Chloride.

vi. Estimation of Lead as Chromate.

vii. Estimation of Nickel as Dimethyglyoximate.

PRACTICAL - V

PHYSICAL CHEMISTRY

1. Colligative Property:

Determination of molecular weight - Rast's macro method.

2. Conductivity:

i. Determination of cell constant.

ii. Determination of equivalent conductance of strong electrolytes – Hydrochloric acid and Potassium chloride.

iii. Determination of dissociation constant of a weak electrolyte - Acetic acid.

iv. Conductometric titration involving strong acid and strong base.

3. Distribution Law:

i. Distribution coefficient of iodine between carbon tetrachloride and water.

ii. Determination of equilibrium constant of the reaction $I_2 + I^- = I^-_3$

4. Heterogeneous Equilibrium:

i. Determination of critical solution temperature of phenol - water system.

ii. Effect of impurity on critical solution temperature.

iii. Construction of the phase diagram of a simple eutectic system by thermal analysis.

iv. Determination of transition temperature of salt hydrates - Sodium acetate, Sodium thiosulphate, Strontium chloride and Manganous chloride.

5. Kinetics:

Determination of rate constant of

i. acid catalysed hydrolysis of an ester.

ii. acid catalysed iodination of acetone.

iii. the reaction between iodide and persulphate.

III Semester **Sub Code : 3ACB1**

ALLIED CHEMISTRY FOR PLANT BIOLOGY & BIO TECHNOLOGY / ZOOLOGY

Unit I : Chemical Bonding :

Molecular Orbital theory - Bonding, anti-bonding and non-bonding orbitals. Bond order. Molecular orbital configuration of H_2, He_2, N_2, O_2, and F_2. Diamagnetism and paramagnetism. Covalent bond, Orbital overlap and hybridisation - Geometry of Organic Molecules - Methane, Ethane, Ethylene, Acetylene and Benzene.

VSEPR Theory

Shapes of $Becl_2$, BF_3, H_2O, NH_3, CH_4, Pcl_5, BrF_3, SF_6, BrF_5 and IF_7 molecules. Ionic bond - Energetics of formation of ionic compounds - Born-Haber cycle. Covalent bond - Polarity of bonds - Fajan's rule - Hydrogen bond - Types and effects Vander Waal's forces – Nature, type and factors affecting Vander Waals forces.

Unit II - Coordination Chemistry

IUPAC nomenclature of mononuclear complexes. Werner's theory Sidgwick's theory and EAN principle. Pauling's theory - Explanation of geometry and magnetic properties. Chelation and its importance with particular reference to EDTA. Biological role of Haemoglobin and Chlorophyll. Applications in qualitative and quantitative analysis.

Unit III : Metallurgy :

General methods of extraction of metals - Types of Ores - methods of oredressing - gravity Separation, magnetic concentration, electrostatic concentration, froth floatation and leaching. Calcination and roasting Reduction, Refining Van Arkel and Zone refining. Extraction of Uranium and Thorium. Role of Carbon in the properties of steel, heat treatment of steel alloy steels and their uses.

Unit IV : Separation Techniques

Solvent extraction - Distribution ratio and Common solvents - Methods of extraction - batch extraction, soxhlet extraction. Chromatography - Principle, Techniques and applications of Column Paper and thin layer chromatography.

Unit V : Carbohydrates and Chemotherapy

Carbohydrates - Classification. Properties and uses of glucose, fructose, sucrose, starch and cellulose. Industrial applications of derivatives of cellulose.

Chemotherapy - Sulphadrugs - Preparation, uses and mode of action. Uses of Penicillin, Chloromycetin, and streptomycin. Definition and one example each for analgesics antipyretics, tranquilisers, sedatives, hypnotic's, local anesthetics and general anesthetics. Cause and treatment of diabetes, cancer and AIDS.

III Semester **Paper ISub Code : 3ACPI**

ALLIED CHEMISTRY FOR PHYSICS

Unit I - Chemical Bonding

Molecular Orbital theory - Bonding, anti-bonding and non-bonding orbitals. Bond order. Molecular orbital configuration of H_2, He_2, N_2, O_2, and F_2. Diamagnetism and paramagnetism. Covalent bond, Orbital overlap and hybridisation - Geometry of Organic Molecules - Methane, Ethane, Ethylene, Acetylene and Benzene.

VSEPR Theory

Shapes of $BeCl_2$, BF_3, H_2O, NH_3, CH_4, Pcl_5, BrF_3, SF_6, BrF_5 and IF_7 molecules. Ionic bond - Energetics of formation of ionic compounds - Born-Haber cycle. Covalent bond - Polarity of bonds - Fajan's rule - Hydrogenbond - Types and eefects, Vander Waal's forces - Nature, type and factors affecting Vander Waals forces.

Unit II : Metallurgy

General methods of extraction of metals - Types of Ores - methods of oredressing - gravity Separation, magnetic concentration, electrostatic concentration, froth floatation and leaching. Calcination and roasting Reduction, Refining Van Arkel and Zone refining. Extraction of Uranium and Thorium. Role of Carbon in the properties of steel, heat treatment of steel alloy steels and their uses.

Unit III : Organic Chemistry :

CH_2Cl_2, $CHCl_3$, CCl_4, Gammaxane, Freon Saccharin, Aspartic acid - Preparation and uses.

Aromatic Compounds - aromaticity - Huckel's rule Electrophilic substitution in benzene - Mechanism of nitration, halogenation, sulphonation, alkylation and acylation.

Naphthalene - Preparation Properties and Structural Elucidation.

Hetrocyclic Compounds - Furan, thiophene, pyrrole and pyridine - preparation and properties.

Unit IV Solutions

Binary liquid mixtures - Ideal Solution - Thermodynamics of ideal solution. vapour pressure - composition and vapour pressure - Temperature curves - Fractional Distillation. Deviation from ideal behaviour partially miscible liquids - phenol - Water System only. Immiscible liquids - Theory and applications of steam distillation. Solution of gases in liquids - Henry's law.

Unit V Phase rule and Photochemistry

Phase rule and the definition of terms in it. Application of phase rule to water system. Reduced Phase rule and its application to a simple eutectic system (Pb-Ag).

Photochemistry : Grothus - Draper's law and Stark - Einstein's law of photochemical equivalence. Quantum yield. Examples of photochemical reactions. Hydrogen - Chlorine reaction. Photo Synthesis. Phosphorescence, Fluorescence, Chemiluminescence and photo sensitisation - definitions with examples.

IV Semester **Paper - II** **Sub Code : 4ACB2**

ALLIED CHEMISTRY FOR PLANT BIOLOGY & BIO TECHNOLOGY / ZOOLOGY

Unit I : Inorganic Chemistry :

Hydrides - Classification, preparation and properties.

Diborane - Preparation, properties and Structure. Preparation and Chemistry of $NaBH_4$, Borazole and BN.

Inter halogen compounds : ICl, BrF_3, IF_5, and IF_7 - Preparation and Properties. Basic properties of iodine. Preparation properties, uses and structure of Peracids of Sulphur. Preparation and uses of Sodium hydrosulphite and Sodium thiosulfate.

Unit II - Industrial Chemistry :

Fuels - Fuel gases - Natural gas, water gas, producer gas, semiwater gas and carburetted gas (Manufacturing details not required) composition and uses only.

Fertilizers - urea ammonium sulphate, ammonium nitrate, potassium nitrate, superphosphate of lime and Triple Superphosphate - Preparation and uses. NPK fertilizers. Micronutrients. Polymers - Silicones, Polyphosphate, Teflon, Polyester and epoxide resins. Preparation and uses. Dyes - Azodyes, Triphenyl methane dyes. Vat dyes and Mordant dyes.

Unit III : Organic Chemistry :

CH_2Cl_2, $CHCl_3$, CCl_4, Gammaxane, Freon Saccharin, Aspartic acid - Preparation and uses.

Aromatic Compounds - aromaticity - Huckel's rule Electrophilic substitution in benzene - Mechanism of nitration, halogenation, sulphonation, alkylation and acylation.

Naphthalene - Preparation Properties and Structural Elucidation.

Hetrocyclic Compounds - Furan, thiophene, pyrrole and pyridine - preparation and properties.

Unit IV Stereo isomerism and Bio-organic Chemistry

Optical isomerism - Symmetry and asymmetry - Elements of Symmetry - Cause of optical activity. Isomerism of lactic acid and tartaric acid. Racemisation - Definition. 2 examples Resolution - Definition - 2 methods of resolution. Asymmetric Synthesis - Partial and Absolute - Definition one example for each. Geometrical isomerism - Maleic acid and fumaric acid.

Ketoenol tautomerism with one example, Amino Acids - classification preparation and properties of alpha amino acids. Peptide Synthesis Classification of proteins by physical properties and biological functions.

Unit V : Electrochemistry :

Ionic equilibria - strong and week electrolytes acid - base common ion effect, pH, buffer solutions and buffer action in biological systems and salt hydrolysis (definitions, examples and equations only (no derivations).

Galvanic cells : EMF and its origin, standard electrode potentials reference electrodes (NHE and Calomel) Electro chemical series and its applications. Formation of Standard Cells, Cell reaction and calculation of EMF lead storage cell. Corrosion and its prevention.

IV Semester **Paper - II** **Sub Code : 4ACP2**

ALLIED CHEMISTRY FOR PHYSICS

Unit I : Inorganic Chemistry :

IUPAC nomenclature of mononuclear complexes. Werner's theory Sidgwick's theory and EAN principle. Pauling's theory - Explanation of geometry and magnetic properties. Chelation and its importance with particular reference to EDTA. Biological role of Haemoglobin and Chlorophyll. Application in qualitative and quantitative analysis.

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Fuels - Fuel gases - Natural gas, water gas, producer gas, semiwater gas and carburetted gas (Manufacturing details not required) composition and uses only.

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Optical isomerism - Symmetry and asymmetry - Elements of Symmetry - Cause of optical activity. Isomerism of lactic acid and tartaric acid. Racemisation - Definition. 2 examples Resolution - Definition - 2 methods of resolution. Asymmetric Synthesis - Partial and Absolute - Definition one example for each. Geometrical isomerism - Maleic acid and fumaric acid.

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Unit V Separation Techniques :

Solvent extraction - Distribution ratio and Common solvents - Methods of extraction - batch extraction, soxhlet extraction. Chromatography - Principle, Techniques and applications of Column Paper and thin layer chromatography.

ALLIED CHEMISTRY PRACTICALS

(Common for Botany / Zoology / Physics Majors)

Volumetric Analysis:

1. Estimation of sodium hydroxide - standard carbonate.
2. Estimation of hydrochloric acid - standard oxalic acid.
3. Estimation of oxalic acid - standard sulphuric acid.
4. Estimation of borax - standard sodium carbonate.
5. Determination of temporary and permanent hardness of water.
6. Estimation of oxalic acid - standard ferrous sulphate.
7. Estimation of potassium permanganate - standard sodium hydroxide.
8. Estimation of ferrous - iron using diphenylamine as internal indicator.
9. Estimation of calcium using EDTA - standard magnesium sulphate.

Organic Analysis:

Reactions of Phenols, Acids (mono and di), Aromatic primary Amine, Aldehydes and Ketones (aliplhatic and aromatic), Diamide and Dextrose. Systematic analysis of organic compounds containing one functional group and characterisation by confirmatory tests or a derivative.