BHAGWANT UNIVERSITY, AJMER

Department of Mathematics

Syllabus

For

B.Sc. Math's (Honors)

Course Category

First Year:-

S. N	Sub. Code	Subject	Course Category	Con. Hrs.per week		EoSE Duration (in Hrs)		Marks Distribution		
				T	P	T	P	IA	EoSE	Tot
1	01ABM101	Communication Techniques	CCC	3	0	3	0	30	70	100
2	01ABM102	Elementary Computer Applications	CCC	3	0	3	0	30	70	100
3	01ABM103	Environmental Studies	CCC	3	0	3	0	30	70	100
4	01ABM104	Inorganic Chemistry	CCC	3	0	3	0	30	70	100
5	01ABM105	Organic Chemistry	CCC	3	0	3	0	30	70	100
6	01ABM106	Physical Chemistry	CCC	3	0	3	0	30	70	100
7	01ABM107	Instrumental Methods Of Analysis	CCC	3	0	3	0	30	70	100
8	01ABM108	Higher Algebra	CCC	3	0	3	0	30	70	100
9	01ABM109	Calculus	CCC	3	0	3	0	30	70	100
10	01ABM110	Geometry & Vector Calculus	CCC	3	0	3	0	30	70	100
11	01ABM111	Discrete Mathematics	CCC	3	0	3	0	30	70	100
12	01ABM112	Mathematical Statistics	CCC	3	0	3	0	30	70	100
13	01ABM201	Practical Chemistry								100
									Total	**1300**

Course Category

Second Year:-

S. N	Sub. Code	Subject	Course Category	Con. Hrs.per week		EoSE Duration (in Hrs)		Marks Distribution		
				T	P	T	P	IA	EoSE	Tot
1	02ABM101	Inorganic Chemistry	CCC	3	0	3	0	30	70	100
2	02ABM102	Organic Chemistry	CCC	3	0	3	0	30	70	100
3	02ABM103	Physical Chemistry	CCC	3	0	3	0	30	70	100
4	02ABM104	Abstract Algebra	CCC	3	0	3	0	30	70	100
5	02ABM105	Differential Equation	CCC	3	0	3	0	30	70	100
6	02ABM106	Mechanics	CCC	3	0	3	0	30	70	100
7	02ABM107	Spherical Astronomy	CCC	3	0	3	0	30	70	100
8	02ABM108	Operation Research	CCC	3	0	3	0	30	70	100
9	02ABM201	Practical Chemistry								100
									Total	**900**

Course Category

Third Year:-

S. N	Sub. Code	Subject	Course Category	Con. Hrs.per week		EoSE Duration (in Hrs)		Marks Distribution		
				T	P	T	P	IA	EoSE	Tot
1	03ABM101	Inorganic Chemistry	CCC	3	0	3	0	30	70	100
2	03ABM102	Organic Chemistry	CCC	3	0	3	0	30	70	100
3	03ABM103	Physical Chemistry	CCC	3	0	3	0	30	70	100
4	03ABM104	Industrial Chemistry	CCC	3	0	3	0	30	70	100
5	03ABM105	Abstract Algebra	CCC	3	0	3	0	30	70	100
6	03ABM106	Analysis	CCC	3	0	3	0	30	70	100
7	03ABM107	Numerical Analysis & Differential Equations	CCC	3	0	3	0	30	70	100
8	03ABM108	Dynamics of Rigid Bodies	CCC	3	0	3	0	30	70	100
9	03ABM109	Fundamental of “C” (Theory)	CCC	3	0	3	0	30	70	100
10	03ABM201	Practical Chemistry								100
									Total	**1000**

First Year:-

01ABM101

Communication Techniques

UNIT- I

- Words and Sentences
- Verbs/Tenses
- Questions / Questions Tags
- Modal Verbs
- The Passive

UNIT- II

- Nouns and Articles
- Determiners
- Reported Speech
- Adjectives and Adverbs

UNIT- III

- Prepositions
- Pronouns
- Conditionals
- Linking Words

UNIT- IV

- Essay and Report Writing
- Review Writing

UNIT- V

- Applications and Letter
- Precis Writing

Suggested Readings:

1. Communication Technique Dr.Nupur Tandon
2. Communication Technique and Grammar Aspects : shukla, Arora Maheswari
3. Professional Communication : Koneru Tata Mc-Graw Hill Publishing Ltd.,New Delhi
4. Communication techniques And Gramatical Aspects : Ruchi ,Dheer ,Jaill, Shukla Pathak ,& Maheswari—CBH Publication
5. Effective Technical Communication : Rizvi –Tata Mc-Graw Hill Publishing Ltd.,New Delhi

01ABM102

Elementary Computer Applications

UNIT- I

Introduction to Information Technology, evolution and generation of computers, type of computers, micro, mini, mainframe and super computer. Architecture of a computer system: CPU, ALU, Memory (RAM, ROM families) cache memory, input/output devices, pointing devices.

UNIT- II

Number system (binary, octal, decimal and hexadecimal) and their inter-conversions, character codes (ASCII, EBCDIC and Unicode). Logic gates, Boolean Algebra, machine, assembly and high level language including 3GL and 4GL.

UNIT- III

Concept of Operating system, need and types of operating systems, batch, single user, multi-processing, distributed and time-shared operating systems. Process and memory management concepts. Introduction to Unix, Linux, Windows, Windows NT systems and their simple commands.

UNIT- IV

Internet: Concepts, email services, world wide web, web browsers, search engines, simple programs in HTML, type of HTML documents, document structure element, type and character formation, tables, frames and forms.

UNIT- V

Word processing packages, standard features like tool bar, word wrap, text formatting, paragraph formatting, effect to text, mail-merge. Presentation Packages: Slide creation, slide shows, adding graphics, formatting, customizing and printing.

01ABM103 **Environmental Studies**

Unit I:

The Multidisciplinary nature of environmental studies Definition , scope and importance Need for public awareness.

Unit II:

Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies, Timber,extraction, mining, dams and their effects on forests and tribal

people, Water resources: Use and over-utilization of surface and groundwater, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water

logging, salinity, case studies. Energy resources: Growing energy needs, renewable and nonrenewable

energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, Land degradation, man induced Landslides, soil erosion and desertification.

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Unit III:

Ecosystems , Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem Ecological succession Food chains, food webs and ecological pyramids .Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem ,Grassland ecosystem . Desert ecosystem Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit IV:

Biodiversity and its conservation, Introduction – Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot- spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife onflicts.Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit V:

Environmental Pollution, Definition, Causes, effects and control measures of Air pollution, Water pollution , Soil pollution ,Marine pollution,Noise pollution, Thermal pollution , Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes.Role of an individual in prevention of pollution .Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

01ABM104

Inorganic Chemistry

Unit- I

Idea of de Brogile matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of ø and ø2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s. p, d orbitals. Aufbau and Pauli exclusion principles,

Hund’s multiplicity rule. Electronic configuration of the elements, effective nuclear charge.

UNIT-II

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 electronpair repulsion (VSEPR) theory to NH3, H3O+, SF4, CIF3, ICl- 2, and H2O,

UNIT-III

MO theory, homonuclear and heteronuclear (CO and NO) diatomi molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

Unit- IV

Periodic Properties

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

s-Block Elements Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, and introduction to alkyls and aryls.

p-Block Elements

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides and halides of groups 13- 16, hydrides of boron-diborane and higher boranes, borazine, properties borohydrides.

Unit- V

Ionic Solids- Ionic structures, radius ratio 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 band theories. Weak Interactions- Hydrogen bonding, van der Waals forces. Fullerenes, carbides, flurocarbons, silicates (Structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides. Chemistry of Noble Gases

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

01ABM105 **Organic Chemistry**

UNIT-I

Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

Mechanism of Organic Reactions

Curved arrow notation, drawing electron movements with arrows, halfheaded and double headed arrows, homolytic and heterolytic bond breaking. Types of reagents-electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediatescarbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with example). Assigning formal charges on intermediates and other ionic species.

UNIT-II

Stereochemistry of Organic Compounds

Concept of isomerism. Types of isomerism. Optical isomerism-elements of symmetry, molecular chirality, enatiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of ennantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism- determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and nbutane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

UNIT-III

Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (withspecial reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity Cycloalkanes- nomenclature, methods of formation,

chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings(cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

UNIT-IV

Alkenes

Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions. Markownikoff 's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration hydroxylation and oxidation with KMnO4. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

Cycloalkenes, Dienes and Alkynes

Methods of formation, conformation and chemical reactions of cycloalkenes. Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation, metal-ammonia reductions, oxidation and polymerization.

UNIT-V

Arenes and aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon- carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity: the Huckle rule, aromatic ions. Aromatic electrophilic substitution- general pattern of the mechanism, role of □ □ and □ □ Complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes and biphenyl.

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, Methods of formation, chemical reaction. Mechanisms of nucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams. Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

01ABM106 Physical Chemistry

UNIT-I

Colloidal State

Definition of colloids, classification of colloids. Solids in liquids (sols): properties- kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions); types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

UNIT-II

Gaseous States

Postulates of kinetic theory of gases, deviation from ideal behavior, van der Waals equation of state.

Critical Phenomena:PV isotherms of real gases, continuity of states, the isotherms of van der Waals equation, relationship between critical constant and van der Waals 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.)

UNIT-III

Liquid State

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

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

UNIT-IV

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 equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method). Catalysis, Characteristics of catalyzed reactions, classification of catalysis, miscellaneous examples.

UNIT-V

Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient. Dilute solution, 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 in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

01ABM107

Instrumental Methods Of Analysis

An introduction to the principles and methods for analysis of chemicals using appropriate instrumentation. All modern analytical methods will be discussed in lecture. Laboratory exercises will emphasize simple preparation and the use of spectrophotometers (UV, VIS, IR), chromatographs (GC and HPLC), electrochemical methods, colorametric and other optical analytical methods

Theory and application of modern instruments in chemical procedures. Standard spectroscopic methods including Fourier transform infrared spectroscopy, nuclear magnetic resonance spectroscopy and ultraviolet spectroscopy. Separation techniques using high pressure liquid chromatography and gas chromatography. Other topics relevant to advanced chemical instrumentation will also be covered.

Electroanalytical and electrogravimetric methods; potentiometric and coulometric methods; conductometric titrations; polarography and amperometric titrations; methods based on infrared,

ultraviolet, and visible spectroscopy; flame photometry; atomic absorption spectrometry; gas chromatographic methods; methods based on nuclear magnetic resonance spectroscopy; fluorescence analysis; mass spectrometry.

01ABM108 – HIGHER ALGEBRA

UNIT-1

Number system, basic binary operations on the set of integers, ordering of the integers, inequalities, well ordering principle, mathematical induction, division algorithm, divisibility principle, and their distributions, greatest common divisor, least common multiple, Euclidian algorithm, fundamental theorem of arithmetic, Fibonacci sequence, linear Diophantine equations, Diophantine equations of second degree, general integer solutions of the equations of $x_2 + y_2 + z_2 = w_2$, $(x, y, z, w) = 1$, $x_n + y_n = w_n$, prime numbers, Goldbach conjecture.

UNIT II

Continued fractions: Conversion, quadratic surd, convergents, formation of convergents, property of convergents, recurring continued fractions, relation between successive convergents, complete quotient, relation between convergents and fraction, the difference.

Recurring series: Order and sum of a recurring series. summation of series.

Theory of equations: General properties of equations , character and position of the roots, representation of equations and its roots graphically.

UNIT III

Relations between roots and coefficients, symmetric functions of roots, transformations of equations, Solutions of cubic equations, solutions of multivariable linear equations using vedic mathematics and other methods.

01ABM109 – CALCULUS

UNIT -1

Tangents and normals, pedal equation, Derivative of the length of an arc,maxima, minima and saddle points of functions of two variables, Lagrange's multiplier method, expansions, partial differentiation, Euler's theorem on homogeneous functions.

UNIT –II

Curvature, various formulae, centre of curvature, chord of curvature and related problems, evolutes, envelopes, asymptotes, concavity and convexity, singular point, double point, curve tracing (in Cartesian and polar co-ordinates.), Jacobians , Beta and Gamma functions.

UNIT –III

Double and triple integrals, Dirichlet's integrals, change of order of integration in double integrals, quadrature, rectification, intrinsic equation, volume and surfaces of solids of revolution.

01ABM 110 VECTOR CALCULUS AND GEOMETRY

UNIT -1

Ellipse and hyperbola: Various properties of ellipse and hyperbola.
General equation of second degree:. Tracing of conics, center of a conic, co-ordinates of the center, equation of the conic referred to center as origin, asymptotes of a conic, lengths and position of axes of a standard conic, eccentricity, foci, directrices, axis, latus rectum of a conic, vertex and focus of the parabola, tracing of ellipse and hyperbola.
The polar equation of a conic: Polar co-ordinates, polar equation of a straight line , circle and conic, focal chord, auxiliary circle, tracing of conic $l/r = 1 + e\cos\theta$, tangents, asymptotes, perpendicular lines, normal, polar to a conic.

UNIT – II

Sphere: Plane section of a sphere, tangent plane, pole and polar plane, orthogonal spheres, radical plane, radical centre.
Cone: Reciprocal cone, right circular cone, enveloping cone.
Cylinder: Right circular cylinder, enveloping cylinder.
Central conicoids: Ellipsoid, tangent plane, polar, polar lines, enveloping cone, enveloping cylinder, section with a given center, normal, conjugate diameters and diametral planes and their properties, general equation of second degree in three dimensions, intersection of a line and a conicoids, tangent lines and tangent plane, condition of tangency, plane section with a given center, diametral plane, principal planes and principal directions.

UNIT – III

Vector differentiation: gradient, divergence and curl, identities involving these operators and related problems.
Vector Integration: Line and surface integral, theorems of Gauss, Green's and Stoke's and problems based on these theorems.

01ABM111 – DISCRETE MATHEMATICS

UNIT-I

Sets Relations and Functions: Combination of sets, finite and infinite sets, uncountable infinite sets, binary relations, equivalence relations and partitions, partial order relations and lattices. Chains and anti-chains, a job scheduling problem, one-to-one, onto and invertible functions, Mathematical functions, exponential and logarithmic functions, sequences, indexed classes of sets, recursively defined functions, cardinality, algorithms and functions.

UNIT-II

Logic and Propositional Calculus: Propositions and compound propositions, basic logical operations, propositions and truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, conditional and bi-conditional statements, arguments, logical implication, propositional functions, quantifiers, negation of quantified statements.
Boolean Algebra: Basic definitions, duality, basic theorems, Boolean algebras as lattices, representation theorem, sum of products form for sets, sum of products from for Boolean algebras, minimal Boolean expressions, prime implicants, logic gates and circuits, truth tables Boolean functions.

UNIT-III

Graph Ttheory: Data structures, graphs and multigraphs , subgraphs ,isomorphic and homeomorphic graphs , paths , connectivity, the bridges of Konigsberg, traversable multigraphs, labeled and weighted graphs, complete, regular and bipartite graphs, tree graphs, planar graphs, graph colorings, shortest paths.
Directed Graphs: Directed graphs, basic definitions ,rooted trees, sequential representation of directed graphs.

01ABM112 –MATHEMATICAL STATISTICS

UNTT-I

Probability: Law of total and compound probability, conditional probability, Bay's theorem, mathematical expectations, moments, moment generating functions, cumulants and cumulant generating functions, measures of skewness and kurtosis.

UNTT-II

Univariat probability distribution: Binomial and Poission's distributions , fitting of Binomial and Poission distribution, rectangular distribution with important properties.

UNIT-III

Normal distribution and its properties, the principle of least squares and curve fitting,
Bivariate distribution: Correlation and regression, multiple and partial correlation.

01ABM201

Practical Chemistry

1. Inorganic Chemistry

Semi-micro Analysis- separation and identification of four ions, cation

analysis from Groups I, II, III, IV, V and VI, anion analysis including

interfering radicals.

2. Organic Chemistry

a) Determination of Melting Point

(Naphthalene),80-82o ,Benzoic acid 121.5-122o

Urea 132.5-133 o , Succinic acid 184.5-185 o

Cinnamic acid 132.5-133o,Salicyclic acid 154.5-158 o

Acetanilide 113.5-114o m-Diniitrobenzene 90o

p-Dichlorobenzene 52o Aspirin 135o

(c) Determination of boiling points

Ethanol 78 o , Cyclohexane 81.4 o , Toluene 110.6 o Benzene 80 o

(d) Mixed melting points

Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

(f) Crystallization

Concept of induction of crystallization

Phthalic acid from hot water (using fluted filter paper and stemless funnel)

Acetanilide from boiling ethanol

Benzoic acid from water

(h) Sublimation (Simple and Vacuum)

Camphor, Naphthalene, Phthalic acid and Succinic Acid.

(B) Qualitative Analysis

Detection of extra elements (N,S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

3. PHYSICAL CHEMISTRY (ANY FIVE)

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature.

2. To study the effect of acid strength on the hydrolysis of an ester.

3To prepare arsenious sulphide sol and compare the precipitating power of mono-,bi- and trivalent anions.

4To determine the percentage composition of a given mixture (non interacting systems) by viscosity method.

5. To determine the viscosity of amyl alcohol in water at different concentrations and calculate the excess viscosity of these solutions.

6. To determine the percentage composition of a given binary mixture by surface tension method (acetone & ethyl methyl ketone).

Course Category

Second Year:-

02ABM101 **Inorganic Chemistry**

Unit I

Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

Chemistry of Elements of Second and Third Transition series

General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Unit II

Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit III

Chemistry of Lanthanide Elements

Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide compounds.

Chemistry of Actinides

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Unit IV

Oxidation and Reduction

use of redox potential data-analysis of redox cycle, redox stability in water- Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

Unit V

Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics reactions in non-aqueous solvents with reference to liquid NH3 and liquid SO2.

02ABM102 Organic Chemistry

Electromagnetic Spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy- absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathchromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infrared (IR) absorption spectroscopy- molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions-cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Unit II

Alcohols

Classification and nomenclature. Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic

nature. Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation ,chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)4 and HIO4] and pinacolpinacolone

rearrangement. Trihydric alcohols- nomenclature and methods of formation, chemical reactions of glycerol.

Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hooesch reaction, Lederer-Manasse reaction and Reimeer-Tiemann reaction.

Unit III

Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of halo acids.Hydroxy acids: malic, tartaric and citric acids. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives

Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substituion. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms

of esterfication and hydrolysis (acidic and basic).

Unit IV

Aldehydes and Ketones

Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-kishner, LiAIH4 and NaBH4 reductions, Halogenation of enolizable ketones. An introduction to á,â unsaturated aldehydes and ketones.

Unit V

Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media Picric acid. Halonitroarenes: reactivity. Structure and nomenclature of amines, physical properties.Stereochemistry of amines. Separation of a mixture of primary, secondary and teritary amines. Structural features effecting basicity of amines. Amines salts as phase-transfer catalysts. Preparation of alkyl and aryl amines(reduction of nitro compounds, nitriles),reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction. Reaction of amines, electrophilic aromatic substitution in aryl aminesreaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

02ABM103 Physical Chemistry

Unit I

Thermodynamics-I

Definition of thermodynamic terms: system, 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. *Thermochemistry:* standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy, Kirchhoff's equation.

Unit II

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. *Third law of thermodynamics*: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz functio(A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G with A with P, V and T.

Unit III

Chemical Equilibrium

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore- Clapeyron equation and

Clausisus- Clapeyron equation, applications.

Phase Equilibrium

Statement and meaning of the terms- phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system- water, CO2 and S systems. Phase equilibria of two component system- solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions- compound formation with congruent melting point (Mg- Zn) and incongruent melting point, (NaCl-H2O), (FeCl3-H2O) and CuSO4- H2O)system. Freezing mixtures, acetone-dry ice. Liquid-liquid mixtures- ideal liquid mixtures, Raoult's an Henry's law. Non-ideal system-azeotropes- HCl-H2O and ethanol – water systems. Partially miscibl liquids-Phenol-water, trimethylamine, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation, applications.

pH Definition of pH and pKa determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hazel equation. Hydrolysis of salts. mCorrosion-types, theories and methods of combating it.

Unit IV

Electrochemistry-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. Migration of ions and Kohlrausch law, Arrehenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution

law its uses and limitations. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary

treatment only). Transport number, definition and determination by Hittorf method and

moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit V

Electrochemistry-II

Types of reversible electrodes-gas-metal ion, metal-insoluble salt anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic 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(G, H, 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.

02ABM104

Abstract Algebra

Unit - I

Ring, Examples of Rings, Ring with unity, Zero divisors, Integral Domain and Fields, their examples and properties. Characteristic of a ring and intergral domain. Subrings, subfields, Prime filed, Ring homomorphism, Embedding of Rings, Field of quotients of an integral domain.

Unit - II

Ideals and their properties. Principal ideal and principal ideal ring, Prime ideal, Maximal ideal. Ideals and Quotient rings, Euclidean rings, Unique Factorisation Domain, Polynomial rings, Remainder theorem, Factor theorem, Polynomials over the rational fields.

Unit - III

Vector Spaces : Definition and examples of a vector spaces, subspaces, Sum and direct sum of subspaces, linear span, linear Dependence, Independence and their basic properties, Basis, finite dimensional vector spaces, Existence theorem for basis, invariance of the number of elements of a basis set, Dimension, existence of complimentary subspace of a subspace of a finite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

Unit - IV

Linear transformations : Linear Transformations and their representation as matrices,thealgebra of linear transformations, Syllaster Law of Nullity. Change of basis, Dual space,Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

Unit - V

Eigenvalues and Eigenvectors, Similar matrices, equivalent matrices,Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalisation of Matrices.

02ABM105

Differential Equation

UNIT - I

Differential equations of first order and first degree, linear differential equations, Bernoulle's equation, Exact differential equations.Differential equations of first order and higher degree;Clairauts form and singular solutions, geometrical interpretation of differential equations, Linear differential equations with constant coefficients, Ordinary homogeneous linear differential equations.

UNIT - II

Linear differential equations of second order, Normal Form, changing the independent variable. Methods of variation of parameters and of operator factors. Simultaneous differential equations, Total differential equations, Exact differential equations of nth order, Riccati's equations, Existence and uniqueness theorems.

UNIT - III

Series solution of differential equations, Power series method, Bessel, Legendre, and Hypergeometric equations.

UNIT - IV

Partial differential equations of the first order, Lagrange's solution, Some special type of equations which can be solved easily by methods other than the general method, Charpit's general method of solutions.

UNIT – V

Partial differential equations of second and higher orders, Classification of linear Partial differential equations of second order, Homogeneous and Nonhomogeneous equations with constant coefficients.

02ABM106

Mechanics

UNIT - I

Analytical conditions of equlibrium of coplanar forces, Friction, Virtual work.

UNIT – II

Common Catenary , Forces in three dimensions, Poinsot's central axis, Stable and unstable equilibrium.

UNIT - III

Velocities and Accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic Motion, Rectilinear motion under variable laws.

UNIT - IV

Hook's law, related problems on horizontal and vertical elastic string , Motion in resisting medium.

UNIT - V

Constrained motion on smooth plane curves (Circular and Cycloidal Motion). Impact (Direct and Oblique). Central orbits, p - r equation, Apses, Time in an orbit, Kepler's laws of planetary motion.

02ABM107

Spherical Astronomy

Spherical Trigonometry: Fundamental formulae of spherical trigonometry, (excluding circles and areas), Solutions of right angled triangles, Latitudes and Longitudes on the surface of the earth. Astronomy: Celestial sphere, Diurnal motion, Twilight, Atmospheric refraction, Meridian circle, planetary motions, Time planetary phenomenon, Precession and notation.

02ABM108

Operation Research

Basics of Operational Research: Origin & Development of Operational Research, Definition and Meaning of Operational Research, Different Phases of an Operational Research Study, Scope and Limitations of Operational Research, Mathematical Modeling of Real Life Problems. Linear Programming: Introduction to Linear algebra. Solution of a system of Linear Equations, Linear independence and dependence of vectors, Concept of Basis, Basic Feasible solution, Convex sets. Extreme points, Hyperplanes and Halfspaces, Convex cones, Polyhedral sets and cones. Linear Programming Problem Formulation, solution by Graphical Method, Theory of Simplex Method, Simplex Algorithm, Two phase Method, Charnes-M Method, Degeneracy, Theory of Duality, Dual-simplex method.

References /Suggested Readings: 1. G. Hadley: Linear Programming. Narosa, Reprint, 2002. 2. G. Hadley: Linear Algebra, Narosa, Reprint, 2002. 3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010. 4. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research- Principles and Practice, John Wiley & Sons, 2005. 5. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.

02ABM201

Practical Chemistry

(**A) Instrumentation**

Colorimetry

(a) Job's method (b) Mole-ratio method

Adulteration- Food stuffs.

Effluent analysis, water analysis.

OR

Solvent Extraction: Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II).

(B) Synthesis of (Any six)

(a) Sodium trioxalato ferrate (III), Na3[Fe(C2O4) 3]

(b) Ni-DMG complex,[Ni(DMG)2]

. (c) Copper tetrammine complex [Cu(NH3)4]SO4.

(d) Cis-and trans-bisoxalato diaqua chromate (III) ion.

(f) p-nitroacetanilide

(g) p-bromoacetanilide

(h) 2,4,6- tribromophenol

(i) Methyl orange

(j) Methyl red

(k) Benzoic Acid

(l) Aniline

(m) m-nitroaniline

(C) Organic Qualitative Analysis

Analysis of an organic mixture containing two solid components using

water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.

(D) Laboratory Techniques

Steam Distillation

Naphthalene from its suspension in water

Clove Oil from cloves

Separation of o-and-p-nitrophenols

OR

Column Chromatography

Separation of fluorescene and methylene blue

Separation of leaf pigments from spinach leaves

Resolution of racemic mixture of (**±**) mandelic acid

OR

Stereochemical Study of Organic Compounds via Models

(i) R and S configuration of optical isomers.

(ii) E,Z configuration of geometrical isomers.

(iii) Conformational analysis of cyclohexane and substituted cyclohexanes.

(E) PHYSICAL CHEMISTRY (ANY SIX)

1. To determine the strength of the given acid conductometrically using

standard alkali solution.

2. To determine the solubility and solubility product of a sparingly soluble

electrolyte conductometrically.

3. To study the saponification of ethyl acetate conductometrically

4. To determine the ionisation constant of a weak acid conductometrically.

5. To titrate potentiometrically the given ferrous ammonium sulphate solution

using $KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of

Fe^{++}/Fe^{+++} system on the hydrogen scale.

6. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.

7. To determine the specific rotation of a given optically active compound

8. Determination of molecular weight of a non-violatile solute by Rast method/ Backmann freezing point method.

9. Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

10. To verify Beer-Lambert law for KMnO4/K2Cr2O7 and determine the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.

2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.

3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.

4. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.

5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.

6. Inorganic Syntheisis, McGraw Hill.

7. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.

8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

9. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.

10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.

11. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.

12. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel

Publishing House.

13. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and

R.Kapoor, S Chand & Co.

14. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose

& Sons.

15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

Course Category

Third Year:-

03ABM101 **Inorganic Chemistry**

Unit-I

Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal field splitting in octahedral , tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Thermodynamic and Kinetic Aspect of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar and octahedral complexes.

Unit-II

Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of ìs and ìeff values, orbital contribution to magnetic moments, application of magnetic moment data

Electronic Spectra of Transition Metal Complexes

Types of electronic transition, selection rules of d-d transitions, spectroscopic ground state, spectrochemical series. Orgel-energy level diagram for d1and d9 states, discussion of the electronic spectrum of [Ti(H2O)6]3+ complexion.

Unit-III

Organometallic Chemistry

Definition, nomenclature and classification of organometallic compounds.Preparation, properties, bonding and applications of alkyls and aryls of Li, Al,Hg, Sn and Ti, a brief account of metal-ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

Unit-IV

Basics of Bioinorganic Chemistry

Essential and trace elements in biological processes, metallporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to Ca2+. Nitrogen fixation.

Unit-V

Hard and Soft Acids and Bases(HSAB)

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Silicones and Phosphazenes

Silicones and phosphazenes as examples of organic polymers, nature of bonding in triphosphazenes.

03ABM102 Organic Chemistry

UNIT-I

Spectroscopy

Nuclear Magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance(1H NMR) spectroscopy, nuclear shielding and dishielding chemica shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2,-

tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

UNIT-II

Organometallic Compounds

Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reaction.

Organozinc compounds:formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

Fats, Oil and Detergents Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

UNIT-III

Organic Synthesis via Enolates

Acidity of á-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethy acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

UNIT-IV

Carbohydrates

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erithro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters, Determination of ring size of monosaccharides.

Cyclic structure of D(+)- glucose. Mechanism of mutarotation. Structure of ribose and deoxyribose.

An introduction to disaccharides(maltose, sucrose and lactose) and polysaccharides(starch and cellulose) without involving structure determination.

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behavior, isoelectric point and electrophoresis. Preparation and reactions of áamino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Structures of peptides and proteins, level of protein structure. Proteins denaturation/ renaturation. Nucleic acids: introduction, Constitution of nucleic acids. Ribnonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT-V

Synthetic Polymers

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Synthetic Dyes

Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and indigo.

03ABM103 **Physical Chemistry**

UNIT-I

Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. de Brogile hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates, of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations

(without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

UNIT-II

Molecular orbital theory

Basic ideas- criteria for forming M.O from A.O, construction of M.O's by LCAO-H2 + ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of ó, ó*,ð, ð* orbitals and their characteristics. Hybrid orbitals-sp, sp2, sp3, calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H2, comparison of M.O. and V.B. models.

UNIT-III

Spectroscopy

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

Rotational Spectrum

Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann 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.

UNIT-IV

Electronic Spectrum

Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle. Qualitative description of ó, ð- and n M.O., their energy levels and the respective transitions.

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Drapper law, Stark- Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluroscence, phosphorescence, nonradiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions- energy transfer processes (simple examples)

UNIT-V

Solutions, Dilute Solutions and Colligative Properties

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficient. Dilute solution, 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 in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass, degree of dissociation and association of solutes.

03ABM104 Industrial Chemistry

Chemical Technology Basic principles of distillation, solvent extraction, solid-liquid leaching and liquidliquid extraction, separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology. 2. Industrial Gases and Inorganic Chemicals (a) Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene. (b) Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate. III Industrial Metallurgy Preparation of metals (ferrous and nonferrous) and ultra pure metals for semiconductor technology.

Suggested Readings 1. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK. 2. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi. 3. J. A. Kent: Riegel s Handbook of Industrial Chemistry, CBS Publishers, New Delhi. 4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi. 5. A. K. De, Environmental Chemistry: New Age International Pvt, Ltd, New Delhi. 6. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.

03ABM105 Abstract Algebra

Unit - I

Ring, Examples of Rings, Ring with unity, Zero divisors, Integral Domain and Fields, their examples and properties. Characteristic of a ring and intergral domain. Subrings, subfields, Prime filed, Ring homomorphism, Embedding of Rings, Field of quotients of an integral domain.

Unit - II

Ideals and their properties. Principal ideal and principal ideal ring, Prime ideal, Maximal ideal. Ideals and Quotient rings, Euclidean rings, Unique Factorisation Domain, Polynomial rings, Remainder theorem, Factor theorem, Polynomials over the rational fields.

Unit - III

Vector Spaces : Definition and examples of a vector spaces, subspaces, Sum and direct sum of subspaces, linear span, linear Dependence, Independence and their basic properties, Basis, finite dimensional vector spaces, Existence theorem for basis, invariance of the number of elements of a basis set, Dimension, existence of complimentary subspace of a subspace of a finite dimensional vector space, dimension of sums of subspaces, quotient space and its dimension.

Unit - IV

Linear transformations : Linear Transformations and their representation as matrices,thealgebra of linear transformations, Syllaster Law of Nullity. Change of basis, Dual space,Dual Basis, Bidual space, Adjoint of a linear transformation, Annihilator of a sub space.

Unit - V

Eigenvalues and Eigenvectors, Similar matrices, equivalent matrices,Similarity of Linear transformations, Reduction to triangular form, Minimal Polynomial. Diagonalisation of Matrices.

03ABM106 Analysis

Unit - I

Real Number System as a complete Ordered Field. The point set theory, Open and Closed sets, Limit point of a set, Neighbourhood, Bolzano-Weierstrass theorem, Heine-Borel theorem, Compactness, connectedness, Cantor's ternary set.

Unit - II

Definition and example of a metric space, Diameter of a set, Bounded set, Open sphere, Interior point and Interior of a set, Derived and Closure of set, Closed set, Closed Sphere, Properties of Open and Closed sets, Boundary point of set. Convergent and Cauchy sequences, Complete metric space, Cantor's Intersection theorem. Dense subset, Baire Catagory theorem.

Unit - III

Limit of a function, Continuous function, Theorem on necessary and sufficient conditions for continuity of a function, Uniform continuity, Contracting mapping, Banach Fixed Point theorem, Equivalant matrices, Compactness, Sequentially compactness, Totally Bounded space, Finite Intersection properties.

Unit - IV

Complex Numbers as ordered pairs, Complex plane, Geometrical representation, Connected and compact sets, Curves and region in the complex plane, Statement of Jordan curves theorem, Extended complex plane and stereographic projection, Complex valued functions limits, Convergence,continuity, Differentiailbility in the extended plane, Analytic functions.Cauchy-Reimann equations (Cartesian and Polar forms).

Unit V

Harmonic functions, Construction of an analytic function, Conformal mapping, Bilinear transformation and its properties, Fixed points, Cross ratio, Inverse point, Elementary maps. , Z , sin Z and log Z

03ABM107 Numerical Analysis & Differential Equations

Second and higher order ordinary linear differential equations with constant Coefficients- complementary function- particular integrals (standard types) Cauchy-Euler differential equation. Simultaneous linear differential equations (two variables) with constant coefficients. Solutions of second order ordinary linear differential equations with variables coefficients by the following methods. (i). When a part of complementary function is given (ii). Changing the independent variable (iii). Changing the dependent variable (iv). Variation of parameters (v). Conditions for exactness and the solution when the equation is exact.

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

03ABM108 Dynamics of Rigid Bodies

Unit I

Introduction – Definition – Velocity – Resultant velocity – Components of velocity and acceleration in cartesian coordinates – Tangents and Normal components of velocity and acceleration - Radial and Transverse components of velocity and acceleration – Motion of a particle along a straight line under uniform acceleration – Problems – Simple Harmonic Motion – Definition - Equations of S.H.M – Properties of S.H.M. – Composition of two S.H.Ms. – Problems.

Unit II

Introduction – Impulse and Impulsive force – Definitions – Principle of conservation of linear momentum – Newton's experimental law – Direct and oblique impact of two smooth spheres – Change in kinetic energy and impulse imparted due to collision – Impact of sphere on a fixed plane - Problems.

Unit III

Two dimensional motion of a particle – Introduction – Projectile – Trajectory - Horizontal range - Velocity of projection - Angle of projection – The path of a projectile is a parabola – Range and time of flight on a horizontal plane –Range and time of flight on an inclined plane – Problems.

Unit IV

Definition – Central force – Central orbit - Areal velocity – Differential equation of the central orbit in polar co-ordinates – p-r equation of the central orbit – Given the central orbit to find the law of force – Given the law of central force to find the orbit - Problems.

Unit V

Moment of Interia of simple bodies – Parallel and Perpendicular axes theorems – Motion of a rigid body about a fixed horizontal axis – Kinetic Energy of rotation – Moment of momentum – Period of oscillation of a compound pendulum – Simple equivalent Pendulum – Interchangeability of centre of suspension and centre of oscillation – Problems.

03ABM109 Fundamental of "C" (Theory)

Introduction to Internet, Connecting to the Internet Hardware , Software & ISPs, Search Engines, Web Portals, Online Shopping, Email – Types of email, Compose and send a message. Reply to a message, Working with emails.

Software and its Need, Types of Software - System software, Application software, System Software - Operating System, Utility Program, Algorithms , Flow Charts - Symbols, Rules for making Flow chart, Programming languages, Assemblers, Compilers and Interpreter, Computer Applications in Business.

Evolution of Computers - Generations, Types of computers, Computer system characteristics, Basic components of a Digital Computer - Control unit, ALU, Input/Output functions and memory, Memory addressing capability of a CPU, Word length of a computer, processing speed of a computer, Computer Classification.

03ABM201 Practical Chemistry

(A) Instrumentation

Colorimetry

(a) Job's method (b) Mole-ratio method

Adulteration- Food stuffs.

Effluent analysis, water analysis.

OR

Solvent Extraction: Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method: Separation and estimation of Mg(II) and Zn(II).

(B) Synthesis of (Any six)

(a) Sodium trioxalato ferrate (III), Na3[Fe(C2O4) 3]

(b) Ni-DMG complex,[Ni(DMG)2]

. (c) Copper tetrammine complex [Cu(NH3)4]SO4.

(d) Cis-and trans-bisoxalato diaqua chromate (III) ion.

(f) p-nitroacetanilide

(g) p-bromoacetanilide

(h) 2,4,6- tribromophenol

(i) Methyl orange

(j) Methyl red

(k) Benzoic Acid

(l) Aniline

(m) m-nitroaniline

(C) Organic Qualitative Analysis

Analysis of an organic mixture containing two solid components using

water, NaHCO3, NaOH for separation and preparation of suitable derivatives.

(D) Laboratory Techniques

Steam Distillation

Naphthalene from its suspension in water

Clove Oil from cloves

Separation of o-and-p-nitrophenols

OR

Column Chromatography

Separation of fluorescene and methylene blue

Separation of leaf pigments from spinach leaves

Resolution of racemic mixture of (±) mandelic acid

OR

Stereochemical Study of Organic Compounds via Models

(i) R and S configuration of optical isomers.

(ii) E,Z configuration of geometrical isomers.

(iii) Conformational analysis of cyclohexane and substituted cyclohexanes.

(E) PHYSICAL CHEMISTRY (ANY SIX)

1. To determine the strength of the given acid conductometrically using standard alkali solution.

2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.

3. To study the saponification of ethyl acetate conductometrically

4. To determine the ionisation constant of a weak acid conductometrically.

5. To titrate potentiometrically the given ferrous ammonium sulphate solution using KMnO4/K2Cr2O7 as titrant and calculate the redox potential of Fe++/Fe+++ system on the hydrogen scale.

6. To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.

7. To determine the specific rotation of a given optically active compound

8. Determination of molecular weight of a non-violatile solute by Rast method/ Backmann freezing point method.

9. Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy.

10. To verify Beer-Lambert law for KMnO4/K2Cr2O7 and determine the concentration of the given solution of the substance.

Books Suggested (Laboratory Courses)

1. Vogel's Qualitative Inorganic analysis, revised, Svehla, Orient Longman.

2. Vogel's Textbook of quantitative Inorganic Analysis (revised), J. Bassett, R.C. Denney, G.H. Heffery and J Mendham, ELBS.

3. Standard Methods of Chemical Analysis, W.W. Scott, The Technical Press.

4. Experimenal inorganic Chemistry, W.G. Palmer, Cambridge.

5. Handbook of Preparative Inorganic Chemistry, Vol, I & II Brauer, Academic Press.

6. Inorganic Syntheisis, McGraw Hill.

7. Experimental Organic Chemistry Vol. I&II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.

8. Laboratory Manual in Organic Chemistry, R.K. Babsal, Wiley Eastern.

9. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.

10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal,East-West press.

11. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw hill.

12. Advanced Practical Physical Chemistry, Vol.I-Physical, J.B.Yadav,Goel Publishing House.

13. Advanced Experimental Chemistry, Vol.I-Physical, J.N. Gurtu and R.Kapoor, S Chand & Co.

14. Selected Experiments in Physical Chemistry, N.G. Mukherjee . J.N. Ghose & Sons.

15. Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.