SCHEME OF EXAMINATION FOR B.Sc. (HONS) IN CHEMISTRY
w.e.f. 2009-10, 2010-2011, 2011-12

B.Sc. Ist (Hons.) Ist Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Time allowed
I	Inorganic Chemistry(Theory)	45	45	5	3 hrs.
II	Physical Chemistry(Theory)	45	45	5	3 hrs.
III	Organic Chemistry(Theory)	45	45	5	3 hrs.

B.Sc.Ist (Hons) IInd Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Time allowed
IV	Inorganic Chemistry(Theory)	45	45	5	3 hrs.
V	Physical Chemistry (Theory)	45	45	5	3 hrs.
VI	Organic Chemistry (Theory)	45	45	5	3 hrs.
VII	Inorganic Chemistry (Practical)	90	50		4 hrs.
VIII	Physical Chemistry (Practical)	90	50		4 hrs.
IX	Organic Chemistry(Practical)	90	50		4 hrs.

Note: Practical exams will be held at the end of 2nd Semester

B.Sc. II (Hons) IIIrd Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Time allowed
X	Inorganic Chemistry (Theory)	45	45	5	3 hrs.
XI	Physical Chemistry (Theory)	45	45	5	3 hrs.
XII	Organic Chemistry (Theory)	45	45	5	3 hrs.

B.Sc. II (Hons) IVth Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Time allowed
XIII	Inorganic Chemistry (Theory	45	45	5	3 hrs.
XIV	Physical Chemistry (Theory)	45	45	5	3 hrs.
XV	Organic Chemistry (Theory)	45	45	5	3 hrs.
XVI	Inorganic Chemistry (Practical)	90	50		4 hrs.
XVII	Physical Chemistry (Practical)	90	50	10	4 hrs.
XVIII	Organic Chemistry (Practical)	90	50	10	4 hrs.

Note: Practical exams will be held at the end of 4t^{h} Semester

B.Sc. IIIrd (Hons.) Vth Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Time allowed
XIX	Inorganic Chemistry-I (Theory)	45	45	5	3 hrs.
XX	Inorganic Chemistry-II (Theory)	45	45	5	3 hrs.
XXI	Physical Chemistry-I (Theory)	45	45	5	3 hrs.
XXII	Physical Chemistry-II (Theory)	45	45	5	3 hrs.
XXIII	Organic Chemistry-I (Theory)	45	45	5	3 hrs.
XXIV	Organic Chemistry-II (Theory)	45	45	5	3 hrs.

B.Sc. III (Hons) VIth Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Time allowed
XXV	Inorganic Chemistry-I (Theory)	45	45	5	3 hrs.
XXVI	Inorganic Chemistry-II (Theory)	45	45	5	3 hrs.
XXVII	Physical Chemistry-I (Theory)	45	45	5	3 hrs.
XXVIII	Physical Chemistry-II (Theory)	45	45	5	3 hrs.
XXIX	Organic Chemistry-I (Theory)	45	45	5	3 hrs.
XXX	Organic Chemistry-II (Theory)	45	45	5	3 hrs.
XXXI	Inorganic Chemistry (Practical)	180	100		6 hrs.
XXXII	Physical Chemistry (Practical)	180	100		6 hrs.
XXXIII	Organic Chemistry (Practical)	180	100		6 hrs.

Note: Practical exams will be held at the end of 6th Semester

B.Sc. I (Hons) Ist Semester

Paper - I (Inorganic Chemistry Theory) **Max. Marks : 45**
Time: 3 hours

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two question from each section. All questions will carry equal marks.*

Section -A

Atomic Structure:-

Historical development of the subject, Bohr's theory and its limitations, idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of φ and φ^2, quantum numbers, normal and orthogonal wave functions, radial and angular wave functions and probability distribution curves, shapes of s, p, d and f orbitals, Aufbau and Pauli exclusion principle, Hund's multiplicity rule electronic configurations of the elements, effective nuclear charge.

(10 Hrs.)

Covalent Bond:

Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridisation and shapes of simple Inorganic molecules and ions. VSEPR Theory of NH_3 , H_3O^+, SF_4 , ClF_3, ICl_2^- and H_2O. MO theory: homonuclear and heteronuclear (CO and NO) diatomic molecules, multicentre bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

(10 Hrs.)

Weak Interactions:

Hydrogen bonding: Types, theory and consequences of Hydrogen Bonding, Vander Waal's forces.

(3 Hrs

Section – B

Periodic Table and Periodic Properties:

Classifications of elements, s.p.d. and f block elements: the long form of the periodic table.
Atomic and ionic radii, ionization energy, electron affinity and Electro negativity - definition, methods of determination of evaluation, trends in periodic table and applications in predicting and explaining the chemical behaviour.

(7Hrs.)

Linnett's Theory:

Important features of ERT, spin correlation and charge correlation effect, double quartet approach, Linnett formulae of some simple molecules as HF, F_2 , C_2H_4 , O_2 , C_2H_2 , N_2 and CO

(5 Hrs.)

Ionic Solids:

Ionic structures , types of ions and packing of ions in crystals size effects, radios ratio effects and co-ordination numbers, limitation of radius ratio rules, lattice defects, semicondjuctors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions fajan's rule.

(8 Hrs.)

Metallic Bond:

Free electron, valence bond and band theories (Alloys excluded) **(3 Hrs.)**

B.Sc. I (Hons) Ist Semester

Paper - II (Physical Chemistry Theory) **Max. Marks : 45**
Time: 3 hours

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

Section - A

Gaseous State

Elementary treatment of gas laws, Real and ideal gases, Boyle's temperature, gas constant R and its numerical values critical constants and their determination. Kinetic gas equation and its derivation, cause of deviation of gases from ideal behaviour, Vander waal's equation and its deviation under different pv isotherms of real gases, isotherms of carbon dioxide, continuity of states. Relationship between critical constants and vander waal's constants, law of corresponding states. Reduced equation of state, liquification of gases (based on joule - Thomson effect.)

Maxwell's distribution law of velocities and energies. Root mean square velocity ,average velocity and most probable velocity and their relationship. Mean free path and its derivation. Collision diameter. Collision number and collision frequency, viscosity of gases. Relationship between mean free path and coefficient of viscosity, calculation of molecular diameter from coefficient of viscosity, degree of freedom of motion and principle of equipartition of energy.

18 hrs.

Surface Chemistry and Colloidal States:

Adsorption, Absorption. Types of adsorption ,difference between them, adsorption isotherms and adsorption isobars. Langmuir adsorptions isotherms and freundlieh adsorption isotherms different isotherms, elementary idea of BET equation and its application.

Section – B

Surface Chemistry

Gibb's adsorption equation and its application. Enzyme catalysis and mechanism of enzyme catalysis, Micharlis- Menton equation application of adsorption.

Liquid and solid states.

Intermolecular forces, structure of liquids (qualitative description, structural differences between solids, liquids and gases, Liquid crystals. Differences between liquid, crystal solid and liquid, classification structure of nematic and chalastric phases, thermography and seven segment of cell, vapour pressure of liquids. Theory of liquids and entropy of vaporization, viscosity and surface tension of liquids.

Crystalline and amorphous solids. Type of unit cells. Laws of crystallography law of constancy of interfaial angeles, law of rational indices, law of symmetry. Symmetry of elements in crystalls. Seven crystal system, Bravis Lattice Bragg's equation and its determination X-ray diffraction of crystals. Determination of crystal structure of NaCl, KCl, CsCl by law's and panders method. **18 hrs.**

B. Sc. (Hons.) I Year (Ist Semester)

Paper III (Theory) Organic Chemistry **Max. Marks: 45**

Time: 3 Hrs.

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SECTION – A

Structure and Bonding **5 Hrs**

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.

Stereochemistry of Organic Compounds **18 Hrs**

Concept of isomerism. Types of isomerism.

Optical isomerism — elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism — determination of configuration of geometrical isomers. E & Z system of nomenclature, geometrical isomerism in oximes and alicyclic compounds.

Conformational isomerism — conformational analysis of ethane and n-butane, 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.

Asymmetric synthesis, elementary idea of stereospecific and stereoselective reactions, Atropisomerism (biphenyls and allenes).

SECTION – B

Mechanism of Organic Reactions **8 Hrs**

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Energy considerations.

Reactive intermediates — carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

Purification of Organic Compounds 5Hrs.

Paper, thin layer, column and gas chromatographic techniques, criteria of purity of organic substances

Alkanes and Cycloalkanes 9 Hrs

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atoms in alkanes. Isomerism in alkanes, sources, methods of formation (with special 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, synthesis of cycloalkanes and their derivatives – addition of carbenes to olefins, Simmons-Smith reaction, photochemical (2+2) cycloaddition reactions, Diels-Alder reaction, dehalogenation of α,ω-dihalides, Dieckman cyclization, pyrolysis of calcium or barium salts of dicarboxylic acids, Blanc's rule, Thorpe-Ziegler reaction, Demjanov rearrangement and by the use of malonic ester and acetoacetic ester, 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.

B.Sc. I (Hons) IIndSemester

Paper - IV (Inorganic Chemistry Theory) **Max. Marks : 45**
Time: 3 hours

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Section -A

s-Block Elements:

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

(7 Hrs.)

Theory of Qualitative and Quantitative Inorganic Analysis:

Chemistry of analysis of various groups of basic and acidic radicals, chemistry of identification of acid radicals in typical combinations. Chemistry of interferences of acid radicals including their removal in the analysis of basic radicals. Theory of precipitation, co-precipitation , post-precipitation, purification of precipitates **15 Hrs.**

Section-B

p-Block Elements - I

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

(12 Hrs.)

p-Block Elements - II

Chemistry of fullereness, carbides, fluorocarbons, silicates (structural principle) tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides.

(8 Hrs.)

Chemistry of Noble Gases:

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

(3 Hrs.)

B.Sc. I (Hons) IInd Semester

Paper - V (Physical Chemistry Theory) **Max. Marks : 45**
Time: 3 hours

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.Section-A **18 Hrs.**

Chemical Kinetics

Chemical kinetics and its scope, Rate of reaction, factors influencing the rate of reaction. Concentration, temperature, pressure, solvent, light, catalyst, concentration dependence of rates. Mathematical characteristics of simple chemical reactions, molecularity and order of reaction. Zero order ,Ist order ,second order, third order reactions and their mathematical derivations for their rate constants.

second order, third order reactions and their mathematical derivations for their rate constants. Half life period, average life period, determination of order reaction. Differential method, method of integration. Method of half life period and isolation method. Pseudo unimolecular reactions

Section-B **18 Hrs**

Electrochemistry-I

Electrical transport conduction in metal and in electrolyte solutions, specific conductance and equivalent conductance. Measurement of equivalent conductance. Variation of equivalent conductance and specfic conductance with dilution, migration of ions, Kohlrausch's law, Arhenious theory of electrolyte dissolution and its limitations. Weak and strong electrolytes. Ostwold's dilution law and its uses and limitation. Debye-Huckel onsager equation for strong electrolytes (elementary treatment only),transport number and its determination by Hittorf and moving boundary method. Application of conductivity measurements, determination of

solubility product of spraningly soluble salts. Determination of degree of dissolution ,Ka for weak acids

T**heromchemistry and chemical energaties:**

Definition of important terms used in thermochemistry. Energy changes during chemical reactions.. Derivation of Ist law of thermodynamus. Heat of reaction, enthalpy and enthalpy change. Enthalpy of formation, combustion, neutralisation, solution, vaporisation, sublimation hydration and fusion, calorfic value of foods. Bond energy and its calculation. Hess's law of heat summation and its application for the calculation of various enthalpies of reaction. Kirchhoff's equation, Spontaneous processes. Criteria of spontaneity., entropy and free energy. Why crisis of energy if conserved in nature.

B. Sc.(Hons.) I Year (IInd Semester)

Paper VI (Theory) Organic Chemistry **Max. Marks: 45**
Time : 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two question from each section. All questions will carry equal marks*

SECTION – A

Alkenes **5 Hrs.**

Nomenclature of alkenes, methods of formation, mechanisms 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 $KMnO_4$,polymerization of alkenes, substitution at the allylic and vinylic positions of alkenes.

Industrial applications of ethylene and propene.

Coal, petroleum and petrochemicals: **5 hrs.**

Coal tar distillation and coal tar chemicals, petroleum origin , fractionation cracking, reforming and aromatisation, petrochemicals, synthetic fuels, octane and cetane numbers, antiknock additives.

Cycloalkenes, Dienes and Alkynes **8 Hrs**

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, hydroboration-oxidation, metal-ammonia reductions, oxidation and polymerization.

Poly Nuclear Hydrocarbons **5 hrs**

Haworth synthesis of naphthalene and phenanthene, pschorr synthesis of phenanthrene, synthesis of anthracene involving Friedal crafts acylation of benzene with phthalic anhydride and Diels Alder reaction between 1,3-butadiene and 1,4-naphthaquinone, reaction of naphthalene, anthracene and phenanthrene, relative reactivities at different positions and mechanism of electrophilic substitution reactions in naphthalene, anthracene and phenanthrene

Section-B

Arenes and Aromaticity **10 Hrs**

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 Huckel rule, aromatic ions, annulenes up to 10 carbon atoms, aromatic, anti - aromatic and non - aromatic compounds.

Aromatic electrophilic substitution — general pattern of the mechanism, role of σ- and π- complexes, mechansim 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 **12 Hrs**

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms and stereochemistry of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams. Study of elimination reactions in alkyl halides, E_1. and E_2 mechanism, substitution vs. elimination, factors affecting substitution/elimination.

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.

B.Sc. Ist (Hons.)
Paper - VII

Inorganic Chemistry Practical: **Max. Marks: 50**
Time: 4 hrs.

1. Semimicro qualitative analysis of mixture containing not more than four radicals (including interfering and excluding insoluble):
Pb^{2+}, Hg^{2+}, Hg_2^{2+}, Ag^{+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, As^{3+}, Sb^{3+}, Sn^{2+}, Fe^{3+}, Cr^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, $NH4^{+}$, CO_3^{2-}, S^{2-}, SO_3^{2-}, $S_2O_3^{2-}$, NO_2^{-}, CH_3COO^{-}, Cl^{-}, Br^{-}, I^{-}, NO_3^{-}, SO_4^{2-}, $C_2O_4^{2-}$, PO_4^{3-}, BO_3^{3-}

2.Volumetric Analysis:
a) Acid base titrations (combinations of strong and weak acids and bases).
b) Oxidation reduction titrations (using $KMnO_4$ and $K_2Cr_2O_7$)

Practical = 30 Marks
Viva-voce = 10 marks
Laboratory = 10 marks
Record

B.Sc. (Hons.) Ist Year
Paper - VIII

Max. Marks: 50
Physical Chemistry Practicals **Time: 4 hrs.**

Thermochemistry

(i) Determination the solubility of different salts (benzoic Acid) and determination of heat of dissolution.
(ii) Determination of enthalpy of neutralisation(strong acid vs strong base, weak acid vs. strong base)..

Colloids:

To prepare As_2S_3 sol and comparing its precipitating power by mono, di and trivalent ions.

Viscosity and Surface tension

1. To determine percentage composition of the given binary mixture by viscosity method.
2. To determine the viscosity of amyl alcohol at different concentration and calculate the

excess viscosity of these solution.

3. To determine the percentage composition of a given binary mixture by surface tension method.

Solution

To determine critical solution temperature

(i) Water - phenol system.

(ii) Water - aniline system.

Adsorption:

To study adsorption of acetic acid on the surface of activated animal charcoal.

B.Sc. (Hons.) Ist Year
(PAPER- IX)
Organic Chemistry Practical

Max.Marks : 50
Time: 4 hrs.

1. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point.

   (i) Iodoform from ethanol (or acetone)
   (ii) M-Dinitrobenzene from nitrobenzene(use 1:2 conc. HNO_3 - H_2SO_4 mixture if fuming HNO_3 is not available).
   (iii) P-Bromoacetanilide from acetanilide
   (iv) Benzoic acid from toluene
   (v) Aniline from nitrobenzene
   (vi) M-Nitroaniline from m-dinitrobenzene
   (vii) Phenyl benzoate from phenol and benzoyl chloride
   (viii) Ethyl benzoate from benzoic acid and ethanol
   (ix) Methyl orange (azo dye)

2. To study the process of (I) sublimation of camphor and phthalic acid, (ii) decolorisation of brown sugar, (sucrose) with animal charcol.
3. Differential extraction.

B.Sc. Part - II (Hons) IIIrd Semester

Paper - X (Theory) Inorganic Chemistry **Max. Marks: 45**

Time: 3 hrs.

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Section – A

Co-ordination 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 **14 Hrs**.

Oxidation and Reduction:

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

8 Hrs.

Section-B

Non-aqueous solvents

Physical properties of solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

5 Hrs

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 Ti, V, Cr, Mn, Fe and Co in various oxidation states.

18 Hrs.

B.Sc. Part - II (Hons) IIIrd Semester

Paper - XI (Theory) Physical Chemistry **Max. Marks: 45**

Time: 3 hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short*

answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two question from each section. All questions will carry equal marks

Section – A **18 Hrs.**

Thermodynamics-I

Important terms used in thermodynamic system, surrounding, type of system intensive and extensive property, state and path function and their differentials, thermodynamic equilibrium thermodynamic process, concept of heat and work, first law of thermodynamics, (statement and derivation). Internal energy and enthalpy, internal energy and enthalpy change and their realtion. Heat capacity. Heat capacity at constant volume and pressure and their relationship. Joule- Thomson effect and inversion temperature, calculation of W, Q, dv and the expansion of ideal gas under isothermal and adiabatic conditions for reversible processes.

Chemical Equilibrium

Types of Reactions (Reversible and irreversible) Equilibrium state. Le-chatelier principle. Law of mass action and its application to derive the law of chemical equilibrium. Thermodynomical derivation of law of chemical equilibrium.

Equilibrium constant and free energy function, isotherms and reaction isochor, Classius - Claperon equation and its application.

Section –B **18 Hrs.**

Colloidal States

Colloids, classification of colloids, solids in liquids (sols) properties: Kinetic, optical and electrical; stability of colloids, protective colloids Hardy-schulze Rule, gold number, Emulsion types of emulsion and their preparation, Emulsifier.

Gels(liquid in solids)

Classification and properties, inhibition and general application of colloids

Distribution Law

Nernst distribution law, Thermodynamic derivation of Nernst distribution law. Conditions for the validity of Nernst distribution law. Derivation of molecular complexity from distribution law. Application of distribution law i.e. calculation of solubility of solute in solvent ,determination of extent of association and dissociation of solute in the solvent, distribution indicator, process of extraction and determination of degree of hydrolysis and study of complex ion formation

B. Sc.(Hons.) II Year (IIIrd Semester)

Paper XII (Theory) Organic Chemistry **Max. marks: 45**

Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two question from each section. All questions will carry equal marks*

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SECTION–A

Alcohols **12 Hrs**

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. Industrial manufacture of methanol (from CO and H_2) and ethanol (flow sheet diagram).

Dihydric alcohols — nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

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

Phenols **6 Hrs**

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-Hoesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

Ethers and Epoxides **4 Hrs**

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

SECTION – B

Ultraviolet (UV) absorption spectroscopy **9 Hrs**

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. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. Woodward-Fieser rules, calculation of λ_{max} of simple conjugated dienes and α,β-unsaturated ketones. UV spectra of conjugated enes , enones, dienones,α,β-unsaturated acids , unsaturated esters, lactones, α,β-unsaturated amides and lactams.

Carboxylic Acids **11 Hrs**

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. Industrial manufacture of acetic acid and benzoic acid(flow sheet diagram).

Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives **3 Hrs**

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 substitution.

Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

B.Sc. Part - II (Hons) IVth Semester

Paper - XIII (Theory) Inorganic Chemistry **Max. Marks: 45**
Time: 3 hrs.

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Section-A

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. Chemistry of Mo and W in different oxidation states, aqueous chemistry of Mo and W(VI), isopoly molybedates and isopolytungustates.

18 Hrs

Acids and Bases:

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

5 Hrs.

Section-B

General Principles of Metallurgy:

General principles of metallurgy, occurrence of metals with special emphasis on mineral wealth of India, calcination roasting, smelting, bessimerization, various methods of concentration, purification and refining (such as parting process, zone refining, oxidation refining, electrolytic refining and solvent extration) metallurgy of important metals like Ag, Au, Zn, Cu, Ni..

12 Hrs.

Chemistry of Lanthanide Elements:

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

6 Hrs.

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.

4 Hrs.

B.Sc. Part - II (Hons) IVth Semester

Paper - XIV (Theory) Physical Chemistry **Max. Marks: 45**

Time: 3 hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two question from each section. All questions will carry equal marks*

Section-A **18 Hrs.**

Thermodynamics - II

Second law of thermodynamics. Need of the law, different definitions of the law, Carnot Cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature. Concept of entropy, entropy as a state function of V and T, entropy as a function of P and T. Entropy change in physical processes. Clausius inequility. Entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases, work function, Gibb,s free energy function. Gibbs function (G) and Helmholtz function (A) as thermodynamic function. Criteria of spontaneity of reversible processes in terms of enthalpy change, entropy change, work function and free energy function. Variation of G and A with P,V and T.

Gibb Helmholtz equation and its application ,clausius- clapeyron equation

Nernst heat theorem. Third law of thermodynamics and its applications. Partial molar quantities. Chemical potential. Gibb's Duhem equation. Gibb,s adsorption equation and its application, variation of chemical potential with temperature and pressure

Section-B **18 Hrs.**

Electrochemistry-II

Redox reactions, electrolytic and galvanic cells. Reversible and irreversible cells reversible electrodes, types of reversible electrodes, metal electrodes, gas metal electrode, metal insoluble salt on ions and redox electrodes, electrode reactions, cell voltage ,function of salt bridge, electrode potential and its determination. Standard hydrogen electrode, reference electrode, standard cell, sign convention. Electrochemical series and its significance.

Nernst equation for a reversible electrode and cell. Calculation of thermodynamic quantities of a cell reaction ΔG, ΔH and K. Polarisation over potential and hydrogen over voltage. Definition of pH. Determination of pH using hydrogen, quinhydron and glass electrode by

potentiometric method. Buffers solution, Buffer action, Henderson - Hazel equation. Hydrolysis of salts, corrosion, types, theories and methods of controlling it.

Chemical Kinetics

Experimental methods of chemical kinetics: conductometric , potentiometric , optical method ,polarimetery and spectrophotometer. Theories of reaction rates, effect of temperature on rate of reaction. Simple collision theory based upon transition state, hard sphere model theory (equilibrium hypothesis). Expression for the rate constants based on equilibrium constant their thermodynamic aspect

B. Sc.(Hons.) II Year (IVth Semester)

Paper XV (Theory) Organic Chemistry **Max. Marks: 45**

Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two question from each section. All questions will carry equal marks*

SECTION–A

Infrared (IR) absorption spectroscopy — 8 Hrs.

molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. Hydrocarbons (saturated and unsaturated), hydroxy compounds, aldehydes, ketones, eseters, anhydrides, amides, amines and nitrocompounds. Applications of UV and IR spectroscopy in structure elucidation of organic compounds.

Organic Compounds of Nitrogen 15Hrs

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 tertiary amines. Structural features affecting basicity of amines. Amine salts as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles, reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction, Hofmann bromamide reaction.

Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid.

SECTION – B

Diazonium Salts: **4 Hrs.**

Mechanism of diazotisation, structure of benzene diazonium chloride, Replacement of diazo group by H, OH, F, Cl, Br, I, NO_2 and CN groups, reduction of diazonium salts to hyrazines, coupling reaction and its synthetic application. Preparation and reactions of cyanides, and isocyanides, urea and diazomethane.

Aldehydes and Ketones **18Hrs**

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, advantage of oxidation of alcohols with chromium trioxide (Sarett reagent) pyridinium chlorochromate (PCC) and pyridinium dichromate. synthesis of aldehydes and ketones using 1,3-dithianes,Gatterman aldehyde synthesis, Gatterman Koch reaction, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Comparison of reactivities of aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, Aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction. Mannich reaction,Michael reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer–Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones.

An introduction to α,β- unsaturated aldehydes and ketones.

B.Sc. II (Hons)
Paper - XVI

Inorganic Chemistry Practical **Max. Marks: 50**
Time: 4 hrs.

Practicals	30 marks
Viva-Voce	10 marks
Laboratory Records	10 marks

Volumetric Analysis

a) Determination of acetic acid in commercial vinegar using NaOH
b) Determination of alkali content - antacid tablet using HCl
c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
d) Estimation of hardness of water by EDTA
e) Estimation of ferrous and ferric by dichromate method.
f) Estimation of copper using thiosulphate.
g) Determination of chloride ion by Mohr's Method & Volhard's method.

Gravimetric Analysis

i) Aluminium as oxinate
ii) Mg as $MgNH_4 PO_4..6H_2O$
iii) Ba as $BaSO_4$

iv) Nickel as (dimethyl glyoxime)
v) Copper as thiocyanate

B.Sc. (Hons.) II nd
Paper - XVII

Physical Chemistry Practicals **Max. Marks: 50**
Time: 4 hrs.

Chemical Kinetics

(i) To determine the specific reaction rates of hydrolysis of ethyl/methyl ester catalysed by hydrogen ion at room temperature.
(ii) To study the effect of acid strength on the hydrolysis of ester.

Electrochemistry

i) Determination of pH of a solution.
ii) Strength of acid by pH - measurement

Refractive Index:

i) To determine the refractive index of given liquid and calculation of specific and molar refractivity.
ii) Determination of concentration of binary mixture by measurement of refractive index.

Electrochemical Cell:

Setting of a Galvanic Cell and determination of cell voltage.

B.Sc. (Hons.) IInd Year
(PAPER XVIII)
Organic Chemistry Practical

Max. Marks: 50
Time: 4 hrs

1. Systematic identification (detection of extra elements, functional groups, determination of melting point or boiling point and preparation of at least one pure solid derivative) of the following simple mono and bifunctional organic compounds. Naphthalene, anthracene, acenaphthene, benzyl chloride, p-dichlorobenzene, m-dinitrobenzene, p-nitrotoluene, resorcinol, hydroquinone, α-naphthol, β-naphthol, benzophenone, ethyl-methyl ketone, benzaldehyde, vanillin, oxalic acid, succinic acid, benzoic acid, salicyclic acid, aspirin, phthalic acid, cinnamic acid, benzamide , urea, acetanilide,benzamide, aniline hydrochloride, p-toluidine, phenyl salicylate (salol), glucose, fructose, sucrose, o-,m-, p-nitroanilines, thiourea.

2. Equivalent weight of acid (neutralization and silver salt method).

3. Estimation of phenol (bromide- bromate method) and aniline (bromide - bromate and acetylation method).

B.Sc. III (Hons.) Vth Semester

Paper -XIX Inorganic Chemistry (Theory) - I **Max. Marks: 45**
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions*

from each section and the candidates will be required to attempt two question from each section. All questions will carry equal marks

Section - A

Metal - ligand Bonding in Transition Metal Complexes:

Limitation 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.

10Hrs.

Magnetic Properties of Transition Metal complexes:

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of μs and μeff values, orbital contribution to magnetic moments, application of magnetic moment data for 3d-metal complexes.

7 Hrs.

Thermodynamic and Kinetic Aspects of Metal Complexes:

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

5 Hrs.

Section-B

Electron Spectra of Transition Metal Complexes:

Types of electronic transitions, selection rules of d-d transitions, spectroscopic ground states, spectrochemical series, Orgel - energy level diagrame for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. **7 Hrs**

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.

7 Hrs.

Silicons, Phosphazenes and S - N compounds:

Synthesis, properties nature of bonding, structures and applications.

9Hrs.

B.Sc. III (Hons.) Vth Semester

Paper -XX Inorganic Chemistry (Theory) - II **Max. Marks: 45**
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

Section - A

Organometallic Chemistry:

Definition, Nature of Metal Carbon bond, classification of organometallic compounds by bond types viz. I)covalent ii) Ionic iii) Electron deficient iv) cluster compounds v) π

bond compounds including sandwitch derivatives. Structure and bonding in Metal carbonyls, cyclopentadienyl derivative, metal-ethylenic, metal-acetylenic complexes, Applications of organometallic compounds as homogeneous catalysts in hydrogenation, hydroformylation, polymerization, oligomerization and metathesis reactions of alkenes and alkynes (Ziegler - Natta polymerization of ethylene and propylene.)

22 Hrs.

Section - B

Bio- Inorganic Chemistry:

Essential and Trace elements in biological processes, bioinorganic chemistry of haemoglobin and myoglobin, vitamin B_{12}, carboxypeptidase A and chlorophyll, biological role of alkali and alkaline earth metal ions with notrogen fixation (special reference to Ca^{2+}. Medicinal aspects of some metal complexes - platinum metal complexes as anticancer agents and their probable mechanism, anticancer activity of cu, Co and Au complexes. Antibacterial and antiviral activity of metal complexes.

20 Hrs.

Corrosion and Passivity:

Theories of corrosion, prevention of corrosion of metals, passivity.

3 Hrs.

B.Sc. III (Hons.) Vth Semester

Paper -XXI Physical Chemistry (Theory) - I **Max. Marks: 45**
Time: 3 Hrs.

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Section-A **18 Hrs.**

Solution and collective - properties

Ideal and Non-ideal solution. Methods of expressing concentrations of solution, activity and activity coefficient. Dilute solution. Colligative properties, Raoults law. Realotive lowering of vapour pressure. Molecular weightdetermination, osmotic law of osmotic pressure and its measurements. Determination of molecular weight by osmotic pressure method. Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weighty and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal molar mass. Degree of dissociation and association of solutes.

Rotational Spectroscopy

Introduction of electromagnatic radiations, regions of the spectrum, basic features of different spectrometers. Statement of the Born-Openheimer approximation, degree of freedom. of

diatomic molecule. Energy level of a rigid rotor (semiclassical principle) selection rule, spectral intensity. Distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-regid rotator. Isotopic effect

Section –B **18 Hrs.**

Phase equilibrium

Statement and meaning of the terms phase, component and degree of freedom. Phase rule and its thermodynamic derivation, phase equilibria of one component system, water and sulfur system, phase equilibria of two component system, solid-liquid equilibria, simple eutetic (Bi-Cd; Pb-silver system), De-solverisation of lead. Solid solution: Compound formation with congruent melting point (Mg-Cu)and incongruent melting point (Nacl-Cu) ($Fecl_3$ and $CuSO_4$ - H_2O) system freezing mixture, acetone, dry ice

Photo Chemistry:

Interaction of radiation with matter. Photo chemical reactions and their difference with thermal reaction law of photo chemistry. Grothus, Drapper law Stark Einstin law, Lambert law, Beer's law. Jablonski diagram depicting various processes occuring in the excited state qualitative description of Fluorescence, phosphorescence non-radiation processes (internal conversion, inter system crossing) quantum yield photosensitized reactions energy transfer processes (some simple examples).

B.Sc. III (Hons.) Vth Semester

Paper -XXII Physical Chemistry (Theory) - II **Max. Marks: 45**
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

Section-A **18 Hrs.**

Statistical Thermodynamics

Statistical thermodynamics of Maxwell Boltzmann distribution law. Maxwell-Boltzmann law and the concept of negative temperature, Maxwell-Boltzmann law of distribution of energy and velocity (evaluation of energy. Derivation of equation of states for a monatomic ideal gas

Nuclear Chemistry and Radioactivity:

Nature of radiation from radioactive substances nuclear structure and nuclear properties. Nuclear reaction, radioactive disintegration series, kinetics of radioactive disintegration. Artificial transmutation of elements. Nuclear fission and nuclear fusion. Radio-carbon dating, synthetic elements. Composition of nuclei:forces operating within the nucleus, nuclear stability and mass energy. Types of nuclear reaction. The compound nuclear theory , scintillation counters. Activation analysis. Isotopic dilution and radioactive titration.

Application

Section-B **18 Hrs.**

Polymers Chemistry

Polymerisation, classification of polymers, natural and synthetic polymers. General methods of preparation. addition and condesation polymer's. Number average molecular weight, Weight average molecular weight. Determination of molecular weight by osmotic, pressure method, viscosity method, light scattering method, kinetics of condensation polymerisation, kinetics of chain polymerisation, kinetics of cationic, anonic and condensation polymerisation. Copolymerisation

Physical properties and Molecular structure

Optical activity, polarization, clausius- mossotti equation , orientation of dipoles in electric field. Dipole moment, induced dipolemoment, measurement of dipolemoment by temperature methods and refrectivity method. Dipolmoment and chemical constitution, magnetic properties - paramagnetic diamagnetic ferrodynamic.

B. Sc. III (Hons).Vth Semester

Paper- XXIII (Theory) Organic Chemistry-I **Max. Marks: 45**

Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

SECTION–A

Spectroscopy **22 Hrs**

Principle of nuclear magnetic resonance,the PMR spectrum,number of signals, peak areas, equivalent and nonequivalent protons positions of signals and chemical shift,shielding and deshielding of protons, proton counting,splitting of signals and coupling constants, magnetic equivalence of protons.Discussion of PMR spectra of the molecules: ethyl bromide, n-propyl bromide, isopropyl bromide, 1,1-dibromoethane, 1,1,2-tribromoethane, ethanol, acetaldehyde, ethyl acetate, toluene, benzaldehyde, acetophenone,*p*-anisidine and *p*-nitrotoluene.Simple problems on PMR spectroscopy for structure determination of organic compounds.

Mass Spectroscopy: Introduction, instrumentation, mass spectrum, determination of molecular formula, parent peak and base peak, recognition of molecular ion peak, fragmentation pattern of alkanes, alkenes and benzene.

SECTION – B

Carbohydrates **10 Hrs**

Classification and nomenclature. Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of glucose and fructose. Open chain and cyclic structure of D(+)-glucose & D(-) fructose. Mechanism of mutarotation.

Structures of ribose and deoxyribose.

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

Organometallic Compounds **10 Hrs**

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

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

Organo lead compounds: formation and chemical reactions.

Organo cadmium compounds: formation and chemical reactions.

Organo copper compounds: formation and chemical reactions.

Organosulphur Compounds **3 Hrs**

Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine. Synthetic detergents alkyl and aryl sulphonates.

B. Sc. III (Hons).Vth Semester

Paper- XXIV (Theory) Organic Chemistry-II **Max. marks: 45**

Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

SECTION–A

Organo Phosphorus Compounds: 6 hrs

Nomenclature, Trivalent phosphorus compounds - trialkyl and triaryl phosphine (method of formation and reactions), Pentavalent phosphorus compounds, organic phosphoranes, phosphorus ylides, wittig reaction. Biological role of phosphorus.

Heterocyclic Compounds 10 Hrs

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six- membered heterocycles. Prepration and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Polymers: **6 hrs**

Brief history of macromolecular Science,

Natural polymers: Starch, cellulose silk resin.

Classification, types of polymerisation: Addition, condensation and their mechanisms(free radical, ionic and coordination - Ziegler Natta Catalyst), methods of polymerisation - bulk suspension, emulsion and solution.

Detailed study of following polymers with respect to synthesis, properties and applications.

(I) Phenol formaldehydes resins.

(II) Urea formaldehydes resins.

(III) Polyesters

(IV) Polyamides.

(V) Natural and synthetic rubbers.

SECTION – B

Organic Synthesis *via* Enolates **6 Hrs**

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

Alkylation of 1,3-dithianes. Alkylation and acylation of enamines

Amino Acids, Peptides, Proteins and Nucleic Acids **11 Hrs**

Classification, structure and stereochemistry of amino acids. Acid-base behavior, isoelectric point and electrophoresis. Preparation and reactions of α-amino 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. Levels of protein structure. Protein denaturation/renaturation.

Purines and pyrimidines: Introduction to purines andpyrimidines, preparation and reactions of adenine, guanine, cytosine, uracil, thymine, tautomerism in purines and pyrimidines.

Nucleic acids: introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Synthetic Dyes **6 Hrs**

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.

B.Sc. III (Hons.) VIth Semester

Paper -XXV Inorganic Chemistry (Theory) - I **Max. Marks: 45**
Time: 3 Hrs.

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Section - A

Analytical Chemistry:
Sources of errors in chemical analysis, classification of errors, precision, accuracy, statistical evaluation and interpretation of results in analytical chemistry (with numericals).
7 Hrs.

Organic Reagents in Inorganic Analysis:

Criteria for choice of organic reagents, use of following reagents in inorganic analysis: DMG, cupferron, 8-hydroxyquinoline, Nitroso β- naphthol, EDTA, Acetylacetone, dithiozone, dithiocarbamate. Advantages and disadvantages of organic reagents in inorganic analysis.

9 Hrs.

Inorganic Polymers:

Definition, classification, polymers based on hetroatomic structure ,PON polymer, polythiazyl, synthetic inorganic fibres Co-ordination polymers.

7 Hrs.

Section - B

Solvent Extraction:

Basic principles of solvent extraction, classification and mechanism of extraction, extraction equilibria, techniques of extraction and applications in analytical chemistry.

7 Hrs.

Ion - Exchange:

Characteristics of ion-exchangers, mechanism of ion-exchange, ion-exchange equilibra, plate theory for ion-exchange, techniques of ion-exchange and applications of ion exchange for separations.

7 Hrs.

Chromatography:

Classification of chromatographic methods, chromatographic terminology - Rf value, partition co-efficient, dyanmics of chromatography, basic principles of adsorption and partition chromatography, applications.

8 Hrs.

B.Sc. III (Hons.) VIth Semester

Paper -XXVI Inorganic Chemistry (Theory) - II **Max. Marks: 45**
Time: 3 Hrs.

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Section-A

Air Pollution:

Primary and secondary pollutants, sources, pollution effects and control of the following: gaseous hydrocarbons, carbon monoxide, carbon dioxide, hydrogen sulphide, oxides of sulfur and nitrogen and ozone, mechanism of photochemical smog formation; Air purification by micro organisms, Acid rain.

8 Hrs

Water Pollution

Types of water pollution, sources of water pollution, approaches to prevent and control water pollution.

8 Hrs.

Industrial Wastes and treatment processes:

Introduction , characteristics of industrial wastes, types of industrial wastes, principles of industrial waste treatment and disposal of industrial wastes.

5 Hrs.

Section-B

Nuclear and Radio- Chemistry

Composition of Nuclei, structure of nucleus, forces operative within nucleus, nuclear stability and mass energy equivalence (binding energy). Nuclear reactions: Types of nuclear reactions, the compound nucleus theories, thermonuclear reactions including fusion and fission reactions, radiation detection and measurement: gaseous ion collection methods (G.M., ionisation and proportional counters) scientillation counter, semi - conductors detectors.

Tracers in Chemistry

Activation analysis, isotopic dilution analysis and radiometric titrations.

17 Hrs.

Crystal Structure:

Structures of binary compounds such as zinc blende, wurtzite, NiAs, CsCl, CaF_2, rutile, β-Crystobalite, CdI_2, BiI_3, ReO_3, corrundum and Mn_2O_3, factors affecting crystal structures.

7 Hrs.

B.Sc. III (Hons.) VIth Semester

Paper -XXVII Physical Chemistry (Theory) -I **Max. Marks: 45**
Time: 3 Hrs.

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Section-A **18 Hrs.**

Vibrational Spectroscopy

Infrared spectrum: energy levels of simple harmonic oscillator. Selection rule. Pure vibration spectrum. Intensity determination of force constant and qualitative relation of force constant and bondenergies, effect of anbhormononic motions and isotope on the spectrum. Idea of vibrational frequencies of different functional gp, rotational - vibration spectrum. Calculation of energy of levels and selection rule

Raman Spectroscopy

Quantum theory of Raman effect. Classical theory of Raman effect. Pure rotational Raman spectra. Raman activity of vibration. Vibration Raman spectra. Rotation - vibration Raman spectrum. Polarisation of light and Raman effect. Experimental technique. Application of Raman effect. Elementary idea of nuclear magnetic resonance. Coupling constant. Chemical shift.

Section-B **18 Hrs.**

Electronic Spectra

Concepts of potential energy curves for bonding and antibonding molecular orbitals. Qualitative description of selection rule. Franck-condon principle. Qualitative description

of , π and δ orbitals and their energy level and their respective transition. Elementary idea of electron spin resonance spectroscopy. Application ESR spectroscopy

Quantum Mechanics:

Dual nature of matter and light. Photoelectric effect ,De-Broglie equation. Heirsenberg's uncertainty principle, Schrodinger wave equation and its significance. Physical inter-pretation of the wave function. Postulates of quantum mechanics. Particle in one and three dimensional box.

B.Sc. III (Hons.) VIth Semester

Paper -XXVIII Physical Chemistry (Theory) -II **Max. Marks: 45**
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

Section-A **18 Hrs.**

Black Body Radiation and Molecular orbitals theory

Planck's law, heat capacity of solids, Bohr's model of hydrogen atom (derivation excluded) and its defects. Compton effect, molecular orbital theory, basic idea, criteria for forming molecular orbital from atomic orbitals. Construction of molecular orbital by linear combination of atomic orbital ,-H_2 ion. Calculation of energy levels from wave function, physical picture of bonding and antibonding wave function. Concept of π, π* orbitals and their characteristics. Hybrid orbital (Sp. Sp^2 and Sp^3.). Calculation of co-efficients of atomic orbitals used in these hybrid orbitals. Introduction of valence bond model of H_2,comparison of molecular orbital. and valence bond. model

Section-B **18 Hrs.**

Catalysis

Homogeneous and Heterogeneous catalysis, Enzyme catalysis. Theory of catalysis - Intermediate compound formation theory, adsorption theory, general characteristics of catalysis, positive catalysis, negative catalysis, autocatalysis, shape selective catalysis.

Chromatography

Classification of chromatographic methods, principle of differential migration, nature of differential migration. Adsorption phenomenon, nature of adsorpent, solvent system. Rf-values, application basic principle of partition, paper, column, thin layer liquid-liquid partition and high performance. Liquid chromatography, paper & column, thin layer liquid-liquid partition and high performance liquid chromatography

B. Sc. (Hons).III Year VIth Semester

Paper XXIX (Theory) Organic Chemistry-I **Max. marks: 45**
Time: 3 Hrs

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

Section - A

Fats, Oil and Detergents: 5 hrs

Occurrence, chemical composition and importance, hydrogenated oils, Rancidity, acid value, sponification and iodine numbers, difference between toilet and washing soaps, comparison of soap and detergents, classification and principle of cleansing action of detergents.

Topics in Biological Chemistry: 12 hrs

Introduction to enzymes, nomenclature, characteristics, general picture of mechanism of enzymes action, co-enzymes: co-enzymes derived from niacin and thiamine, lipoic acid, co-enzyme- A, energy production in biological system, glycolysis, tricarboxylic acid cycle.

Fermentation 6 hrs

Anaerobic and aerobic fermentation, production of alcohol, citric acid and lactic acid.

Section –B

Drugs: 22 hrs

Introduction, relation of chemical structure and physiological activity with suitable examples, mechanism of chemotherapeutic action. Nomenclature of organic chemical systems, stereochemical notations. General aspects, preparation and uses of the following drugs:

(i)	Analgesics and antipyretics	:	paracetamol, Aspirin
(ii)	Anti-inflammatory	:	Ibuprofen
(iii)	Sulpha	:	Sulphacetamide
(iv)	Local anaesthetics	:	Benzocaine
(v)	Anti amoebic	:	Metronidazole
(vi)	Antimalarials	:	Chloroquinine
(vii)	Antihistamines	:	Chlorophenizamine Maleate
(viii)	Antifungal		Undecylenic acid
(ix)	Insect repellants	:	Dibutyl phthalate
(x)	Antiseptics and disinfectants		Chloro cresol, povidone – Iodine
(xi)	Antibiotics		Chloroamphenicol

B. Sc. (Hons).III Year Vth Semester

Paper XXX (Theory) Organic Chemistry-II Max. marks: 45

Time: 3 Hrs

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 04 questions from each section and the candidates will be required to attempt two questions from each section. All questions will carry equal marks*

Section - A

Terpenoids: 10 hrs

Introduction, essential oils, classification of terpenes, isolation, isoprene rule, isolation, structure elucidation and synthesis of citral and geraniol.

Alkaloids 12 hrs

Introduction, classification, extraction, physiological action in alkaloids, general characteristics, general methods of determining

Section-B

Pesticides: 10 hrs

-Classification, Natural pesticides: Nicotinides, Pyrethroids, Rotenoide, Sabodilia, Ryania, Synthetic pesticides: Nitrophenols, Halogens derivatives of aromatic hydrocarbons and alicyclic hydrocarbons, organo phosphorus pesticides. Preparation, reactions and uses of DDT, BHC, Malathion and Parathion.

Vitamins 7hrs

Introduction, classification, pro vitamins, occurrence , structure and deficiency diseases of vitamins A, B complex (B_1, B_2, B_6 and B_{12}), C, D, E, H and K

Harmones: 6 hrs

Introduction, functions, difference between harmones and vitamins, classification and study of Thyroxine, Adrenalin, Insulin, Testosterone, Progesterone, Estrogens, Cortison (structure , secreting gland and functions).

B.Sc.III

Paper - XXXI Inorganic Chemistry Practical: **Max. Marks : 100**
Time: 6 Hrs.

Practicals	=	60 marks
Viva-Voce	=	20 marks
Lab. Records	=	20 marks

Inorganic Synthesis:

(a) Preparation of sodium trioxalate ferrate (III) , $[Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permaganatometry.
(b) Preparation of copper tetraammine complex $[Cu(NH_3)_4]\ SO_4$
(c) Preparation of cis and trans- bisoxalato diaqua chromate (III) ion.
(d) Mercuric tetrathiocyanato cobaltate (II) , $Hg\ [Co(SCN)_4]$

2 (a) **Colorimetry**: To verify Beer-Lambert law for $KMno_4/K_2Cr_2O_7$ and determine the concentration of the given $KMnO_4/\ K_2Cr_2O_7$ solution.

(b) **Solvent extraction**
Separation and estimation of Fe (II) (estimation by colorimetrically)

1. Analysis of insoluble:

Only one to be given ($PbSO_4$, AgCl, AgBr., AgI, $BaSO_4$, $SrSO_4$, $CaSO_4$,, CaF_2, SiO_2 and Al_2O_3)

B.Sc. IIIrd (Hons)

Paper-XXXII

Physical Chemistry Practical **Max. Marks : 100**
Time: 6 hrs.

Distribution Law

i) To study the distribution of Iodine between H_2O and CCl_4

ii) To study distribution of benzoic acid in benzene and water. To study the equilibrium constant of complex reach e.g. $I^- + I_2 - I_3^-$

Buffer Solution:

Preparation of buffer solution.

(NH_4Cl, NH_4OH) CH_3CooH and CH_3 COONa and determination of pH of buffer solution.

Phase equilibrium:

To study the effect of solute (NaCl, succinic Acid) on the critical solution temperature of two partially miscible liquid (e.g. water -phenol) and to determine the concentration of that solute in the given water -phenol system.

Conductometric Titration:

(1) Determine of cell constant of the conductivity cell.
(2) Determination of solubility and solubility product of the given sparingly soluble salt.
(3) Determination of molar conductance of the salt by conductometric method.
(4) Conductometric titrations of strong acid vs strong base.

Potentiometric Titration:

(i) Potentiometric titration of strong/weak and against weak/strong base.
(ii) To titrate the given $FeSO_4$ $NH_2(SO_4)_2$ $6H_2O$ solution using $KMnO_4$/ $K_2Cr_2O_7$ as titrant and calculate redox potential of Fe^{2+}/ Fe^{3+} system on the hydrogen scale.

Specific Rotation (Polarimetery)

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

Colorimetry:

(i) To verify the Lembert Beer's Law using $KMnO_4$/ $K_2Cr_2O_7$ solution.
(ii) Determination of concentration of unknown solution of substance.

B.Sc. (Hons.) IIIrd year
(PAPER XXXIII)
Organic Chemistry Practical

Max. Marks: 100
Time: 6 hrs

1. Laboratory Techniques

(a) **Steam distillation**

Naphthalene from its suspension in water
Separation of o-and p-nitrophenols

(b) **Column chromatography**

Separation of fluorescein and methylene blue
Separation of leaf pigments from spinach leaves

2. Thin Layer Chromatography

Determination of R_f values and identification of organic compounds.

(a) Separation of green leaf pigments (spinach leaves may be used)
(b) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5: 1.5)

3. Paper Chromatography

Determination of R_f values and identification of organic compounds

(a) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid . Spray reagent-ninhydrin.
(b) Separation of mixture of D,L-alanine, glycine and L-leucine using n-butanol : acetic acid water (4:1:5). Spray reagent-ninhydrin.

4. Synthesis of the following organic compounds:

(a) p-Nitroacetanilide from acetanilide and its hydrolysis to p-nitroaniline.
(b) 1,3,5-Tribromobenzene from aniline.
(c) Qhthalimide from phthalic anhydride and its rearrangement to anthranilic acid.
(d) Benzanilide from benzophenone.

5. **Determination of :**

(a) Acid value: Resin, Plasticizers
(b) Iodine number : Linseed oil, Castrol oil
(c) Saponification value : coconut oil, polyester.