SCHEME OF EXAMINATION FOR B.Sc. (HONS) IN CHEMISTRY
w.e.f. 2011-12, 2012-13, 2013-14

B.Sc. Ist (Hons.) Ist Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Exam duration
101	Inorganic Chemistry(Theory)	45	40	10	3 hrs.
102	Physical Chemistry(Theory)	45	40	10	3 hrs.
103	Organic Chemistry(Theory)	45	40	10	3 hrs.
104	Optional Paper-I	45	40	10	3 hrs.
105	Optional Paper-II	45	40	10	3 hrs.
106	English	45	40	10	3 hrs.
107	Practical (101, 102, 103)	60 each	50+50+50		3+3+3 hrs.
108	Practical (104,105)	60 each	50+50		3+3 hrs.

Total marks of B.SC. Ist Semester =550 (500 if math as optional)

B.Sc.Ist (Hons) IInd Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Exam duration
201	Inorganic Chemistry(Theory)	45	40	10	3 hrs.
202	Physical Chemistry (Theory)	45	40	10	3 hrs.
203	Organic Chemistry (Theory)	45	40	10	3 hrs.
204	Optional Paper-I	45	40	10	3 hrs.
205	Optional Paper-II	45	40	10	3 hrs.
206	English	45	40	10	3 hrs.
207	Practical (201,202,203)	60 each	50+50+50		3+3+3 hrs.
208	Practicals (204, 205)	60 each	50+50		3+3 hrs.

Total marks of B.SC. IInd Semester =550 (500 if math as optional

B.Sc. II (Hons) IIIrd Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Exam duration
301	Inorganic Chemistry (Theory)	45	40	10	3 hrs.
302	Physical Chemistry (Theory)	45	40	10	3 hrs.
303	Organic Chemistry (Theory)	45	40	10	3 hrs.
304	Optional Paper-I	45	40	10	3 hrs.
305	Optional Paper-II	45	40	10	3 hrs.
306	Practicals (301,302,303)	60 each	50+50+50		4 hrs.
307	Practicals (304,305)	60 each	50+50		4 hrs.

Total marks of B.SC. IIIrd Semester =500 (450 if math as optional)

B.Sc. II (Hons) IVth Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Exam duration
401	Inorganic Chemistry (Theory	45	40	10	3 hrs.
402	Physical Chemistry (Theory)	45	40	10	3 hrs**.**
403	Organic Chemistry (Theory)	45	40	10	3 hrs**.**
404	Optional Paper-I	45	40	10	3 hrs.
405	Optional Paper-II	45	40	10	3 hrs.
406	Practicals (401,402,403)	60 each	50+50+50		3+3+3 hrs.
407	Practicals (404,405)	60 each	50+50		3+3 hrs.

Total marks of B.SC. IVth Semester =500 (450 if math as optional

B.Sc. IIIrd (Hons.) Vth Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Exam duration
501	Inorganic Chemistry-I (Theory)	45	40	10	3 hrs.
502	Inorganic Chemistry-II (Theory)	45	40	10	3 hrs.
503	Physical Chemistry-I (Theory)	45	40	10	3 hrs.
504	Physical Chemistry-II (Theory)	45	40	10	3 hrs.
505	Organic Chemistry-I (Theory)	45	40	10	3 hrs.
506	Organic Chemistry-II (Theory)	45	40	10	3 hrs.
507	Practical (501)	90	50		6 hrs.
508	Practical (502)	90	50		6 hrs.
509	Prtactical (503)	90	50		6 hrs.

Total marks of Vth Semester = 450

B.Sc. III (Hons) VIth Semester

Paper No.	Nomenclature of the Paper	Hours	Maximum Marks Written	I.A.	Exam duration
601	Inorganic Chemistry-I (Theory)	45	40	10	3 hrs.
602	Inorganic Chemistry-II (Theory)	45	40	10	3 hrs.
603	Physical Chemistry-I (Theory)	45	40	10	3 hrs.
604	Physical Chemistry-II (Theory)	45	40	10	3 hrs.
605	Organic Chemistry-I (Theory)	45	40	10	3 hrs.
606	Organic Chemistry-II (Theory)	45	40	10	3 hrs.
607	Practical (601)	90	50		6 hrs.
608	Practical (602)	90	50		6 hrs.
609	Practical (603)	90	50		6 hrs.

Total marks of VIth Semester = 450

Each student will opt two optional subjects from - Physics, Mathematics, Statistics, Botany & Zoology in B.Sc. (Hons.) I, II, III & IVth Semesters. Total marks in B.SC. (Hons.) Chemistry Course will be 550+550+500+500+450+450 = 3000 without math optional. Or
500+500+450+450+450+450 = 2800 with math as one of the optional papers.

B.Sc. I (Hons) Ist Semester

Paper -10 I (Inorganic Chemistry Theory) **Max. Marks : 40**
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

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 - 102 (Physical Chemistry Theory) **Max. Marks : 40**
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 **23 hrs.**

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.

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 **22 hrs.**

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.

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

Paper 103 (Theory) Organic Chemistry **Max. Marks: 40**
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

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 - 201 (Inorganic Chemistry Theory) **Max. Marks : 40**
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

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 - 202 (Physical Chemistry Theory) **Max. Marks : 40**
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 **23 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 **22 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 203 (Theory) Organic Chemistry **Max. Marks: 40**
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.)
B.Sc. Ist Sem. (Hons) & B.Sc. IInd Sem. (Hons)

Inorganic Chemistry Practical (101) Max. Marks: 50 Times: 3 hrs.
Inorganic Chemistry Practical (201) Max. Marks: 50 Times: 3 hrs.

Half of the following experiments will be performed in Ist Semester and rest in 2nd Sem. Each semester practical examination will be of 50 marks. Distribution of marks will be as under:

Practical	=	40 marks
Viva-Voce	=	05 marks
Lab. records	=	05

1. Semi micro 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:
Acid base titrations (combinations of strong and weak acids and bases).
Oxidation reduction titrations (using $KMnO_4$ and $K_2Cr_2O_7$)

B.Sc. Ist Sem. (Hons) & B.Sc. IInd Sem. (Hons)

Physical Chemistry Practical (102) Max. Marks: 50 Times: 3 hrs.
Physical Chemistry Practical (202) Max. Marks: 50Times: 3 hrs.

Half of the following experiments will be performed in Ist Semester and rest in 2nd Sem. Each semester practical examination will be of 50 marks. Distribution of marks will be as under:

Practical	=	40 marks
Viva-Voce	=	05 marks
Lab. records	=	05 marks

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

To determine percentage composition of the given binary mixture by viscosity method.
To determine the viscosity of amyl alcohol at different concentration and calculate the excess viscosity of these solution.
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. Ist Sem. (Hons) & B.Sc. IInd Sem. (Hons)

Organic Chemistry Practical (103) Max. Marks: 50 Times: 3 hrs.
Organic Chemistry Practical (203) Max. Marks: 50Times: 3 hrs.

Half of the following experiments will be performed in Ist Semester and rest in 2nd Sem. Each semester practical examination will be of 50 marks. Distribution of marks will be as under:

Practical	=	40 marks
Viva-Voce	=	05 marks
Lab. records	=	05 marks

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 – 301 (Theory) Inorganic Chemistry **Max. Marks: 40**
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.

Paper – 302 (Theory) Physical Chemistry **Max. Marks: 40**
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 **23 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 **22 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 303 (Theory) Organic Chemistry **Max. Marks: 40**
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 - 401 (Theory) Inorganic Chemistry **Max. Marks: 40**
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

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 - 402 (Theory) Physical Chemistry **Max. Marks: 40**

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 **22 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 **23 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- 403 (Theory) Organic Chemistry **Max. Marks: 40**

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)
B.Sc. IIIrd Sem (Hons) & B.Sc. IVth Sem (Hons)

Inorganic Chemistry Practical (301) Max. Marks: 50 Time: 3 hrs.
Inorganic Chemistry Practical (401) Max. Marks: 50 Time: 3 hrs.

Half of the following experiments will be performed in Ist Semester and rest in 2nd Sem. Each semester practical examination will be of 50 marks. Distribution of marks will be as under:

Practicals	40 marks
Viva-Voce	05 marks
Laboratory Records	05 marks

Volumetric Analysis

Determination of acetic acid in commercial vinegar using NaOH
Determination of alkali content - antacid tablet using HCl
Estimation of calcium content in chalk as calcium oxalate by permanganometry.
Estimation of hardness of water by EDTA
Estimation of ferrous and ferric by dichromate method.
Estimation of copper using thiosulphate.
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

B.Sc. IIIrd Sem (Hons) & B.Sc. IVth Sem (Hons)

Physical Chemistry Practical (302) Max. Marks: 50 Time: 3 hrs.
Physical Chemistry Practical (402) Max. Marks: 50 Time: 3 hrs.

Half of the following experiments will be performed in Ist Semester and rest in 2nd Sem. Each semester practical examination will be of 50 marks. Distribution of marks will be as under:

Practicals	40 marks
Viva-Voce	05 marks
Laboratory Records	05 marks

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

B.Sc. IIIrd Sem (Hons) & B.Sc. IVth Sem (Hons)

Organic Chemistry Practical (303) Max. Marks: 50 Time: 3 hrs.
Organic Chemistry Practical (403) Max. Marks: 50 Time: 3 hrs.

Half of the following experiments will be performed in Ist Semester and rest in 2nd Sem. Each semester practical examination will be of 50 marks. Distribution of marks will be as under:

Practicals	40 marks
Viva-Voce	05 marks
Laboratory Records	05 marks

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 -501 Inorganic Chemistry (Theory) - I **Max. Marks: 40**
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 -502 Inorganic Chemistry (Theory) - II **Max. Marks: 40**
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 -503 Physical Chemistry (Theory) - I **Max. Marks: 40**
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 **23 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 **22 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 -504 Physical Chemistry (Theory) - II **Max. Marks: 40**
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 **22 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 **23 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- 505 (Theory) Organic Chemistry-I Max. Marks: 40

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- 506 (Theory) Organic Chemistry-II Max. Marks: 40

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 -601 Inorganic Chemistry (Theory) - I **Max. Marks: 40**
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

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 -602 Inorganic Chemistry (Theory) - II **Max. Marks: 40**
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

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 -603 Physical Chemistry (Theory) -I **Max. Marks: 40**
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 **23 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 **22 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 -604 Physical Chemistry (Theory) -II **Max. Marks: 40**
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 **22 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 **23 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- 605 (Theory) Organic Chemistry-I Max. Marks: 40

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- 606 (Theory) Organic Chemistry-II Max. Marks: 40

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

B.Sc. 5th Sem. & B.Sc. 6th Sem.

Inorganic Chemistry Practical (501) M.M. 50 Time: 6 hrs.
Inorganic Chemistry Practical (601) M.M. 50 Time: 6 hrs.

Half of the experiments will be performed in 5th Semester and rest in 6th Semester. Distribution of marks will be as under:

Practicals	=	40 marks	Practicals	=	40 marks
Viva-Voce	=	05 marks	Viva-Voce	=	05 marks
Lab. Records	=	05 marks	Lab. records	=	05 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)

B.Sc. 5th Sem. & B.Sc. 6th Sem.

Physical Chemistry Practical (502) M.M. 50 Time: 6 hrs.
Physical Chemistry Practical (602) M.M. 50 Time: 6 hrs.

Half of the experiments will be performed in 5th Semester and rest in 6th Semester.
Distribution of marks will be as under:

Practicals	=	40 marks
Viva-Voce	=	05 marks
Lab. records	=	05 marks

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
B.Sc. 5th Sem. & B.Sc. 6th Sem.

Organic Chemistry Practical (503) M.M. 50 Time: 6 hrs.
Organic Chemistry Practical (603) M.M.50Time: 6 hrs.

Half of the experiments will be performed in 5th Semester and rest in 6th Semester.
Distribution of marks will be as under

Practicals	=	40 marks	Practicals	=	40 marks
Viva-Voce	=	05 marks	Viva-Voce	=	05 marks
Lab. records	=	05 marks	Lab records	=	05 marks

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.

Max. Marks 40

Time: 03 hrs.

Zoology

B.SC. (HONS) CHEMISTRY

Syllabus of Zoology as Optional subject
PAPER-1 (Ist Semester)
BIODIVERSITY-I: NON-CHORDATA

THEORY

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 02 questions from each section and the candidates will be required to attempt one questions from each section. All questions will carry equal marks*

General account of Non-Chordates:

UNIT 1

Protozoa General characters and Reproduction in Protozoa.
Metazoa Origin of metazoa,
Porifera General characters and Structural organization of *Sycon.*
Cnidaria General characters and Polymorphism in Cnidarians

UNIT I1

Platyhelminthes General characters and *Fasciola:* Structure and life history
Aschelminthes General characters and Life history of *Ascaris* and its parasitic adaptations.

UNIT I1I

Annelida General characters and Adaptive radiations in Polychaeta.
Arthropoda General characters and Larval forms of crustacea; metamorphosis in Insecta

UNIT IV

Mollusca General characters and Torsion and detorsion
Echinodermata General characters and Water-vascular system and larval forms

Max Marks 50
Time: 03 hrs.

PRACTICALS

Protozoa:

1. Examination of *Amoeba* , *Euglena, Paramecium, Ceratium, Noctiluca, and Vorticella.*

Porifera:

2. Study of *Sycon* (including T.S. and L.S.). *Euplectella;*

3. Temporary mounts of spicules, gemmules and spongin fibres.

Cnidaria:

4. Study of *Obelia, Sertularia, Millepora, Aurelia, and Metridium* (including T.S. and L.S).

Platyhelminthes:

5. Study of *Fasciola, Taenia,, Echinococcus;* life history and sections of *Fasciola* and *Taenia*

Aschelminthes:

6. Study of male and female *Ascaris* (including sections).

Annelida:

7. **Demonstrations through CD/charts etc:** digestive and nervous systems of earthworm.
8. **Temporary mounts:** Ovary, pharyngeal and septal nephridia of earthworm.
9. **Slides:** T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.
10. **Specimens:** *Aphrodite, Heteronereis, Chaetopterus, Pheretima, Tubifex, Hirudinaria*.

Arthropoda:

11. **Demonstrations through CD/charts etc:** digestive and nervous systems of cockroach.
12. **Specimens/slides:** *Limulus* , spider, crustacean larvae, *Daphnia, Balanus, Sacculina, Cancer* , Eupagurus, *Scolopendra, Julus* , termite, louse, wasp, honeybee, silkmoth and *Peripatus.*

Mollusca:

13. **Demonstrations through CD/charts etc:** digestive system of *Pila* ; Temporary mounts-radula and gill of *Pila* .

15. **Specimens:** *Chiton, Dentalium, Unio, Ostrea, Teredo, Loligo, Sepia, Octopus* and *Nautilus.*

Echinodermata:

16. **Slides:** T. S. arm of *Pentaceros,* Echinoderm larvae.

17. **Specimens:** *Pentaceros, Ophiura, Echinus. Cucumaria, and Antedon.*

SUGGESTED BOOKS

1. Barnes, R.D. Invertebrate Zoology (1982) VI Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. & J.I., Spicer (2002) The Invertebrates: A New Synthesis. III Edition. Blackwell Science.
3. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
4. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
5. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press.

Max. Marks 40
Time: 03 hrs

ZOOLOGY PAPER-2 (IInd Semester) Optional
BIODIVERSITY-II: CHORDATA

THEORY

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 02 questions from each section and the candidates will be required to attempt one questions from each section. All questions will carry equal marks*

General account of Chordates:

UNIT I

1. Chordates Introduction and origin.

2. Protochordates General features and Phylogeny of Hemichordates, Urochordates and Cephalochordates. Retrogressive metamorphosis.

UNIT II

3. Agnatha General features of living Agnatha

4. Pisces Osmoregulation, Migration and Parental care.

UNIT III

5. Amphibia Origin and evolution of terrestrial ectotherms, Parental care.

6. Reptiles Origin,Poisonous and non- poisonous snakes in India, Biting mechanism in snakes, Affinities of *Sphenodon.*

UNIT IV

7. Aves Origin, Flight adaptations, Mechanism of flight and Migration.

8. Mammals Origin of Mammals. Origin and evolution of human

Max. Marks: 50
Time: 03 hrs.

PRACTICALS

1. Protochordata:
Study of Balanoglossus , *Herdmania, Branchiostoma*
Balanoglossus sections through Probosis, Collar, branchiogenital & hepatic region.
Amphioxus - oral hood, Whole Mount sections through pharyngeal, intestinal & caudal regions .

2. Fishes:
Study of *Petromyzon, Scoliodon, Sphyrna, Pristis, Trygon, Torpedo, Chimaera, Notopterus, Labeo, Catla, Cirrihina, Heteropneustes, Mystus, Exocoetus.*
Demonstrations through CD/charts etc: Cranial nerves of *Scoliodon.*
Temporary unstained preparation of Placoid, Cycloid and Ctenoid scales.

3. Amphibia:
Study of *Necturus, Salamander, Bufo, Hyla, Rhacophorus.*

4. Reptiles:
Study of *Chelone, Testuda, Kachuga, Hemidactytus, Varanus, Uromastix, Chameoleon, Draco, Hydrophis, Bungarus, Viper, Krait* , Coral snakes, Crocodiles.

5. Aves:
Study of dozen Birds of local place/district/Zoo/National park

6. Mammals:
Study of *Sorex/Hedgehog*, Bat (Insectivorous & frugivorous).

SUGGESTED BOOKS

1. Kardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGraw-Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000).Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Young, J.Z. (2004). The life of vertebrates. III Edition. Oxford university press.
4. Hall B.K. and Hallgrimsson B. (2008).Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers, Inc.

Max. Marks 40
Time: 03 hrs

ZOOLOGY PAPER-3(Semester-III) Optional
ANIMAL PHYSIOLOGY AND FUNCTIONAL HISTOLOGY
(With reference to human)

THEORY

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 02 questions from each section and the candidates will be required to attempt one questions from each section. All questions will carry equal marks*

UNIT I

1. Digestive system

Structure and types of mode of digestive system and its glands; Process of digestion, assimilation and various disorders.

2. Respiratory system

Structure and functions of respiratory system; Control and coordination of respiration.

UNIT II

3. Nervous System

General organization: Neuron resting membrane potential and its basis; Origin of action potential and its propagation in myelinated and unmyelinated nerve fibers; Synaptic transmission and types of synapses, Neuro-muscular junction; Physiology of hearing and vision.

UNIT III

4. Muscle

Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit.

5. Reproductive System

Histology of male and female reproductive systems, Puberty, physiology of male and female reproduction; Methods of contraception (depicted through flow chart); Disorders of reproductive system.

UNIT IV

6. Endocrine System

Histology and functions of endocrine glands; Nature of hormones; Mode of action of hormones; Hypothalamus- principal nuclei involved in control of endocrine system, control of anterior pituitary hormones by hypothalamic releasing hormones (neuroendocrine mechanisms).

Max. Marks 50
Time: 03 hrs

PRACTICALS

1. Recording of simple muscle twitch with electrical stimulation.
2. Demonstration of the knee jerk reflex.
3. Preparation of temporary mounts: Squamous epithelium, Ciliated epithelium, Striated muscle fibres and nerve cells.
4. Examination of sections of Mammalian skin, Cartilage, Bone, Pancreas, Testis, Ovary, Pituitary, Adrenal, Thyroid, Parathyroid.
5. Preparation of permanent slide of any five mammalian tissues- Microtomy.

SUGGESTED BOOKS

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. / W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John wiley & sons, Inc.
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional Correlations. XII Edition. Lippincott W. & Wilkins.
4. Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders

Max. Marks 40

Time: 03 hrs

B.Sc. Hons Chemistry IVth Semester
ZOOLOGY PAPER-IV Optional
GENOMICS

Theory

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 02 questions from each section and the candidates will be required to attempt one questions from each section. All questions will carry equal marks*

Unit I

Elementary idea of gene mapping in bacteria, Transposons and transposition mechanisms
Types of mutations and nomenclature

Unit II

Mutagenesis & Types of DNA repair, DNA repair pathways
Error-prone repair and mutagenesis

Unit III

Gene families: Multigene families with conserved domains, Repetitive DNA
General account of Comparative Genomics: Overview of prokaryotic and eukaryotic genomes

Unit IV

The Genome project: History, organization and goals of human genome project, Mapping strategies.
Mitochondrial genome

Max. Marks 50

Time: 03 hrs

Practicals:

Detection of mutations
Ames test
Mutation inducing agents
Project report on human genome
Feasible as per the facilities available in the institute

Suggested Reading Material

Pasternak, An Introduction to Molecular Human Genetics
Strachan and Read, Human Molecular Genetics
Sudbery, Human Molecular Genetics
G. Grandi. 2003, Genomics, proteomics and Vaccines
S.B. Primrose, 2004, Genomics : Applications in Human Biology
J. Zhou, D.K. Thompson, T. Xu, J.M. Tiedge, 2004, Microbial functional Genomics, Proteomics & Bioinformatics

B.Sc. (Hons.) Chemistry Ist Semester

. (Optional Physics) Paper-I

Periods 45
Max. Marks: 40
Internal Assessment: 10

NOTE:

The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of fourteen marks will be compulsory having seven parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section A

Mechanics

Mechanics of single and system of particles, conservation of laws of linear momentum, angular momentum and mechanical energy, Centre of mass and equation of motion, constrained motion, degrees of freedom.

Generalised coordinates, displacement, velocity, acceleration, momentum, force and potential. Hamilton's variational principle, Lagrange's equation of motion from Hamilton's Principle. Linear Harmonic oscillator, simple pendulum, Atwood's machine.

Section B

Properties of Matter

Elasticity, Hooke's law, Elastic constants and their relations, Poisson's ratio, torsion of cylinder and twisting couple. Bending of beam (bending moment and its magnitude) cantilevers, Centrally loaded beam.

Theory of Relativity

Reference systems, inertial frames, Gallilean invariance and Conservation laws, Newtonian relativity principle, Michelson - Morley experiment : Search for ether. Lorentz transformations length contraction, time dilation, velocity addition theorem, variation of mass with velocity and mass energy equivalence.

Section C

Electrostatic Field

Derivation of field E from potential as gradient, derivation of Laplace and Poisson equations. Electric flux, Gauss's Law and its application to spherical shell, uniformly charged infinite plane and uniformily charged straight wire, mechanical force of charged surface, Energy per unit volume.

Magnetostatistics

Magnetic Induction, magetic flux, solenoidal nature of Vector field of induction. Properties of B (i) $\nabla.B = 0$ (ii) $\nabla \times B = \mu_o J$. Electronic theory of dia and para magnetism (Langevin's theory). Domain theory of ferromagnetism. Cycle of Magnetisation - Hysteresis (Energy dissipation, Hysteresis loss and importance of Hysteresis curve). Maxwell's Equations and their derivation.

References

1. Electricity and Magnetism by A.S.Mahajan and A.A. Rangwala (Tata MC Graw Hill)
2. Classical Mechanics by H. Goldstein (2nd Edition)
3. Berkeley Physics Course, Vol. I, Mechanics by E.M. Purchell
4. Properties of Matter by D.S. Mathur.

B.Sc. Ist Sem. (Optional Physics)
Practicals

Max. Marks: 50
Time : 3 Hrs.

SPECIAL NOTES

1. Do any eight experiments.
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment :	= 30 marks
Viva Voce :	= 10 marks
Lab Record :	= 10 marks
Total	= 50 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

1. Moment of Inertia of a fly-wheel
2. M.I. of an irregular body using a torsion pendulum.
3. Surface Tension by Jeager's method.
4. Young's modulus by bending of beam.
5. Modulus of rigidity by Maxwell's needle.
6. Elastic constants by Searle's method.
7. Viscosity of water by its flow through a uniform capillary tube.
8. Thermal conductivity of a good conductor by Searle's method.
9. Mechanical equivalent of Heat by Callendao and Barne's method.
10. 'g' by Bar pendulum.
11. Surface tension by capillary method.

B.Sc. (Hons.) Chemistry IInd Semester

. (Optional Physics) Paper-II

Periods 45
Max. Marks: 40
Internal Assessment: 10

NOTE:

The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of fourteen marks will be compulsory having seven parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section A

Semiconductor Diodes

Energy bands in solids. Intrinsic and extrinsic semiconductor, Hall effect, P-N junction diode and their V-I characteristics. Zener and avalanche breakdown. Resistance of a diode, Light Emitting diodes (LED). Photo conduction in semiconductors, photodiode, Solar Cell.

Diode Rectifiers

P-N junction half wave and full wave rectifier. Types of filter circuits. Zener diode as voltage regulator, simple regulated power supply.

Transistors

Junction Transistors, Bipolar transistors, working of NPN and PNP transistors, Transistor connections (C-B, C-E, C-C mode), constants of transistor. Transistor characteristic curves (excluding h parameter analysis), advantage of C-B configuration. C.R. O. (Principle, construction and working in detail).

Section B

Transistor Amplifiers

Transistor biasing, methods of Transistor biasing and stabilization. D.C. load line. Common-base and common-emitter transistor biasing. Common-base, common-emitteer amplifers. Classification of amplifers. Resistance-capacitance (R-C) coupled amplifer (two stage; concept of band width, no derivation). Feed-back in amplifers, advantage of negative feedback Emitter follower.

Oscillators

Oscillators, Principle of Oscillation, Classification of Oscillator. Condition for self sustained oscillation ; Hartley oscillator.

Section C

Lasers

Main features of a laser : Directionality, high intensity, high degree of coherence, spatial and temporal coherence, Einstein's coefficients and possibility of amplification, momentum transfer, life time of a level, kinetics of optical obsorption. Threshold condition for laser emission, Laser pumping, He-Ne laser and RUBY laser (Principle, Construction and Working). Applications of laser in the field of medicine and industry.

References

1. Electricity and Magnetism by Reitz and Milford (Prentice Hall of India)
2. Lassers, Theory and Application (2nd Ed.) by Thagrajan and Ajay Ghatak.
3. Laser and Nonlinear Optics by B.B. Laud (2nd Ed.)
4. Basic Electronics and Linear circuits by N.N. Bhargava, D.C. Kulshreshtha and S.C.Gupta (TITI, CHD).
5. Electronic Fundamentals and Applications by J.D. Ryder (Prentice Hall India).

B.Sc. IInd Sems. Optional Physics

PRACTICALS

Max. Marks: 50
Time : 3 Hrs.

SPECIAL NOTES

1. Do any eight experiments .
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment :	= 30 marks
Viva Voce :	= 10 marks
Lab Record :	= 10 marks
Total	= 50 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

1. Low resistance by Carey Foster's Bridge with calibration.
2. Frequency of A.C. mains and capacity by elctrical vibrator.
3. Frequency of A.C. mains by sonometer using an electromagnet.
4. High resistance by substitution method.
5. To draw forward and reverse bias characteristics of a semiconductor diode.
6. Zener Doide volage regulation characteristics.
7. Verification of Inverse square law by photo-cell.
8. To study the characteristics of a solar cell.
9. e/m by Thomson method.
10. Transistor as voltage Amplifier in C-B Configuration.
11. Transistor as voltage Amplifier in C-E Configuration.
12. Study of B-H Curve by C.R.O.
13. Study of Hartley Oscillator (Calibration of Gang Condenser).

B.Sc. (Hons.) Chemistry IIIrd Semester

Optional Physics Paper-III

Max. Marks: 40
Internal Assessment: 10
Time: 3 Hrs.

Note: The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of fourteen marks will be compulsory having seven parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section - A

Interference

Interference by Division of Wavefront : Fresnel's Biprism and its applications to determination of wave length of sodium light and thickness of a mica sheet, Lioyd's mirror, phase change on reflection.

Interference by Division of Amplitude :Colour of thin, films, wedge shaped film, Newton's rings.

Interferometers: Michelson's interferometer and its application to (I) Standardisation of a meter (II) determination of wave length.

Section - B

Diffraction

Fresnel's Diffraction : Fresnel's half period zones, zone plate, diffraction at a straight edge, rectangular slit and circular apperture.

Fraunhoffer diffraction : One slit diffraction, Two slit diffraction, N-slit diffraction, Plane transmission grating spectrum, Dispersive power of a grating , Limit of resolution, Rayleigh's criterion, resolving power of telescope and a grating.

Polarisation

Polarisation and Double Refraction : Polarisation by reflection, Polarisation by scattering, Malus law, Phenomenon of double refraction, Huytgen's wave theory of double refraction (Normal and oblique incidence), Analysis of Palorised light : Nicol prism, Quarter wave plate and half wave plate, production and detection of (i) Plane polarized light (ii) Circularly polarized light and (iii)Elliptically polarized light, Optical activity, Fresnel's theory of rotation, Specific rotation, Polarimeters (half shade and Biquartz).

Section C

Nuclear Physics

Nuclear mass and binding energy, systematics nuclear binding energy, nuclear stability, Nuclear size, spin, parity, statistics magnetic dipole moment, quadrupole moment (shape concept).

Interaction of heavy charged particles (Alpha particles), alpha disintegration and its theory Energy loss of heavy charged particle (idea of Bethe formula, no derivation), Energetics of alpha -decay, Range and straggling of alpha particles. Geiger-Nuttal law.

Introduction of light charged particle (Beta-particle), Origin of continuous beta-spectrum (neutrino hypothesis) types of beta decay and energetics of beta decay, Energy loss of beta-particles (ionization), Range of electrons, absorption of beta-particles.

Interaction of Gamma Ray, Nature of gamma rays, Energetics of gamma rays, passage of Gamma radiations through matter (photoelectric, compton and pair production effect) electron Positron anhilation. Asborption of Gamma rays (Mass attenuation coefficient) and its application.

References :

1. Optics by Ajay Ghatak, Tata McGraw Hill 1977.
2. Introduction of Optics by Frank L. Pedrotti and Leno S. Pedrotti, Prentice Hall 1987.
3. Nuclear Physics by D.C. Tayal, Umesh Prakashan, 125, Goblind Dev Khurja (UP).
4. Nuclear Physics by W.E. Burcham.

B.Sc. IIIrd SemsOptional Physics

PRACTICALS

Max. Marks : 50
Time : 3 Hrs.

SPECIAL NOTES

1. Do any eight experiments .
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment :	= 30 marks
Viva Voce :	= 10 marks
Lab Record :	= 10 marks
Total	= 50 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

1. To measure the (a) area of a window (b) height of an inaccesible object.
2. Refractive index and dispersive power of a prism material by spectrometer.
3. Determination of wave length of Na light and the number of lines per cerntimeter using a diffraction grating.
4. Wave length by Newton's Rings.
5. Resolving power of a telescope.
6. Comparision of Illuminating Powers by a Photometer.
7. Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter.
8. Diameter of Lycopodium powder particies by Carona rings.
9. To study double slit interference by He-Ne laser.
10. Diameter of a thin wire by diffraction method (using He-Ne Laser).
11. Young's modulus by Newtons rings method.
12. Resolving power of a prism.
13. Thickness of a thin plate using air wedge.
14. Resolving Power of plane transmission grating.

B.Sc. (Hons.) Chemistry IVth Semester

Optional Physics

Periods 45
Max. Marks: 40
Internal Assessment: 10
Time: 3 Hrs.

The syllabus is divided into three units. Eight questions will be set in all. Question No.1 of fourteen marks will be compulsory having seven parts, each of two marks covering the whole syllabus. In addition there will be at least two questions from each unit and student is required to answer five questions in all, selecting at least one question from each unit.

Section - A

Computer Programming

Computer organisation, Binary representation, Algorithm development, flow charts and their interpretation.

Fortran Preliminaries; Integer and floating point arithmetic expression, built in functions executable and non-executable statements, input and output statements, Formats, I.F. DO and GO TO statements, Dimesion arrays statement function and function subprogram.

Section B

Statistical Mechanics

Probability, some probability considerations, combinations possessing maximum probability, combinations possessing minimum probability, distribution of molecules in two boxes. Case with weightage (general). Phase space, microstates and macrostates, statistical fluctuations constraints and accessible States Thermodynamical probability.

Postulates of Statistical Physics. Division of Phase space into cells, Condition of equilibrium between two system in thermal contact. b-Parameter. Entropy and Probability, Boltzman's distribution law. Evaluation of A and b. Bose-Einstein statistics, Application of B.E. Statistics to Plancks's radiation law, B.E. gas

Section C

Quantum Mechanics

Failure of (Classical) E.M. Theory. quantum theory of radiatio (old quantum theory), Photon, photoelectric effect and Einsteins photoelectric equation compton effect (theory and result). Inadequancy of old quantum theory, de-Broglie hypothesis. Davisson and Germer experiment. G.P. Thomson experiment. Phase velocity group velocity, Heisenberg's uncertainty principle. Time-energy and angular momentum, position uncertainty, Uncertainty principle from de-Broglie wave, (wave-partice duality). Gamma Ray Microscope, Electron diffraction from a slit.

Derivation of time dependent Schrodinger wave equation.

References:

1. Rajaraman, Fortran Programming.
2. Schaum Series, Fortran 77.
3. Ram Kumar, Programming with Fortran - 77.
4. B.B. Laud, "Introduction to Statistical Mechanics" (Macmillan 1981).
5. F. Reif, "Statistical Physics' (McGraw Hill 1988).
6. Quantum Mechanics by L.I. Schiff, McGraw Hill Book Company, Inc.
7. Quantum Mechanics by B. Crasemand and J.D. Powel (Addison Wesley.

B.Sc. IV Sems. OptionalPhysics

PRACTICALS

Max. Marks: 50
Time: 3 Hrs.

SPECIAL NOTES

1. Do eight experiments .(Four from each section)
2. The students are required to calculate the error involved in a particular experiment (percentage error).

NOTE

1. Distribution of Marks :

Experiment : = 30 marks
Viva Voce : = 10 marks
Lab Record : = 10 marks
Total = 50 marks

For giving marks under Lab. Record each college will maintain practical assessment record by using the following procedure :-

1. Each student has to peform a minimum number of experiments prescribed in the syllabus.
2. After the completion of a practical the teacher concerned will check the note-book and conduct the viva-voce of each student to find out how much concepts related to the theoertical and experimental part of the experiment he/she has understood. According to his/her performance marks will be recorded in their practical note book. These marks will constitue the lab record.
3. To complete the final marks for lab. record a separate register for each class of B.Sc will be maintained. The Student will be assigned a separate page on the register. On this page the marks obtained by the student in different practicals will be recorded. While taking the final average the total marks obtained willbe divided by the total no. of required practicals, instead of the number of practicals performed by the student. This record will be signed by the concerned teacher.
4. The lab. record register will be presented to the external practical examiners for lab. record marks. The external examiners will verify the record randomly.

PRACTICALS

(i) Electronics

1. To draw common base and common emitter characteristics of a transistor and calculate transistor characteristics parameters.
2. To study the ripple factor in a d.c. power supply.
3. To draw frequency response curve of transistorised R.C. coupled amplifier.
4. To find out the frequency of a tuning fork by Melde's experiment.
5. Study of series and parallel resonance circuits.
6. Electronic Voltmeter measurement of peak, average & R.M.S. valus of signal.
7. Study of voltage doubler and trippler circuits.

(ii) Computer Experiments

1. To print out all natural (even/odd) number between given limits using computer.
2. To find maximum, minimum and range of a given set of numbers using computer.

3. To evaluate sum of finite series.
4. Find the roots of a quadratic equation.
5. To find intergration of a definite integral by trapezoidal rule.
6. To find the area of a triangle, sphere and cylinder.
7. Given value for a,b,c and d and a set of values for the variable x evaluate the function defined by

$F(x) = ax^2+bx+c$ if $x<d$

$F(x) = O$ if $x=d$

$F(x) = ax^2+bx-c$ if $x>d$

For each value of x, and print the value of x and F(x). Write a program for an arbitary number of x values.

B.Sc. (Hons.) Chemistry
Mathematics-I Optional
(First Semester) Paper-I

Max.Marks: 40

Time: 3Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section-I

Sets, Relation and Functions, Relations between the roots and coefficients of general polynomial equation in one variable. Nature of the roots of an equation, Descarte's rule of signs. Permutations and Combinations. Bionomial Theorem for positive integral indices. Logarithms. Exponential Series and Logarithmic Series.

Section-II

Trignometric Functions. Trignometric functions of sum and difference of two angles. Trignometric equations. Limit of a function. Basic properties of Limits. L'Hospital's rule. Continuous functions.

Section-III

Derivative of a function. Derivative of standard functions. Derivative of implicit functions. Logarithmic differentiation. Derivatives of functions in parametric form. Stationary points, Maxima- Minima problems, Inflexion points.

Section-IV

Integration as inverse of differentiation. Indefinite integrals of standard forms. Integration by parts, by partial fractions and by substitution. Formal evaluation of definite integrals. Reduction formulae. Double and triple integrals.

Books Recommended:

1. Chandrika Prasad : Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.
2. Marvin J. Forray: Calculus with Analytic Geometry, Macmillan Publishing Co.,Inc.,New York.
3. Shanti Narayan:Differential and Integral Calculus.
4. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).
5. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
6. Steiner, E. The Chemical Maths Book Oxford University Press 1996).
7. Yates, P. Chemical Calculations. 2nd Ed. CRC Press (2007).

B.Sc. (Hons.) Chemistry IInd Semester
Mathematics-II Optional
(Second Semester)

Max.Marks: 40
Time: 3Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Matrices. Operations on matrices. Determinants. Adjoint and inverse of a matrix, Rank of a matrix. Simultaneous equations: method of substitution and elimination, Consistency and independence. Homogeneous linear equations. Simultaneous equations with more than two unknowns, Cramer's rule, matrix eigen values and eigenvectors, Diagonalization of a matrix.

Section – II

Definition of a group with example and simple properties of groups, Subgroups, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Lagrange's theorem. Normal subgroups, Quotient groups,

Section – III

Cartesian Coordinates, Distance between two points, Various forms of the equation of a line. General equation of a line. Circle, Parabola, Ellipse and Hyperbola.

Section – IV

. Scalars and Vectors. product of two vectors, product of three vectors. Vector differentiation. Gradient of a scalar point function, Divergence and curl of vector point function. Gradient, divergence and curl of sums and product and their related vector identities(without proofs). Laplacian operator.

Books Recommended:

1. Shanti Narayan: A Text book of matrices
2. I.N.Herstein: Topics in Algebra.
3. Shanti Narayan: A Text Book of vector calculus.
4. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books(2008).
5. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
6. Steiner, E. The Chemical Maths Book Oxford University Press (1996).

B.Sc. (Hons.) Chemistry IIIrd Semester

Mathematics-III Optimal
(Third Semester)

Max.Marks: 40
Time: 3Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section – I

Continuity, Sequential Continuity, Properties of Continuous functions, Uniform Continuity, Chain rule of Differentiability. Mean Value Theorems; Rolle's Theorem and Lagrange's Mean value theorems. Taylor's theorem with various forms of remainders

Section – II

Limit and continuity of real valued functions of two variables. Partial differentiation, Total Differential; Composite functions & Implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor 's theorem for functions of two variables.

Section – III

Differential equations: Definition and formation of ordinary differential equations of first order and first degree,Variable separable,Homogeneous equations,Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Partial differential equations: Formation, order and degree,Solutions of Linear and Non-Linear Partial differential equations of the first order.

Section – IV

Linear partial differential equations of second and higher orders, Linear and non-linear homogeneous and non-homogeneous equations with constant co-efficients.

Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Books Recommended:

1. Shanti Narayan : A Course in Mathemtical Analysis, S.Chand and company, New Delhi.
2. S.C. Malik : Mathematical Analysis, Wiley Eastern Ltd.
3. D.A.Murray: Introductory Course on Differential Equations, Orient Longman, (India), 1967.
4. S.L.Ross: Differential equations, John Wiley and Sons.
5. Ian N.Sneddon : Elements of Partial Differential Equations, McGraw Hill Book Company, 1988.
6. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books(2008).
7. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
8. Steiner, E. The Chemical Maths Book Oxford University Press (1996).
9. Yates, P. Chemical Calculations. 2nd Ed. CRC Press (2007).

B.Sc. (Hons) Chemistry IVth Semester

Mathematics-IV Optional
(Fourth Semester)

Max. Marks: 40
Time: 3Hours

Note: The question paper will consist of **five** sections. Each of the first four sections(***I-IV***) will contain two questions and the students shall be asked to attempt **one** question from each section. **Section-V** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.**

Section-I

Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Newton-Raphson's method.
Numerical Integration: Trapezoidal rule, Simpson's one-third and three-eighth rule, Gauss Quadrature formula

Section-II

Concepts in Probability: Random experiment, trial, exhaustive, equally likely and independent events. Definition of probability- classical , relative frequency, statistical and axiomatic approach, Addition and multiplication laws of probability.Baye'stheorem

Section-III

Correlation for Bivariate Data: Concept and types of correlation, Scatter diagram, Karl Pearson Coefficients(r) of correlation and rank correlation coefficient. Linear Regression: Concept of regression, two lines of regression, properties of regression coefficients. Difference between correlation and regression.

Section-IV

Test of significance:t-test for single mean,Chi-square test,ANOVA for one way and two way classified data.

Books Recommended :

1. Babu Ram: Numerical Methods, Pearsons Publications
2. M.K. Jain, S.R.K.Lyengar, R.K. Jain : Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
3. A.M.Goon,M.K.Gupta and B.Dass Gupta: Fundamentals of Statistics, Vol.1
4. S.C.Gupta and V.K.Kapoor: Fundamentals of Mathematical Statistics,Sultan Chand and Sons,2002.
5. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).
6. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
7. Steiner, E. The Chemical Maths Book Oxford University Press (1996).
8. Yates, P. Chemical Calculations. 2nd Ed. CRC Press (2007).

B.Sc Chemistry (Hons.)

Botany Optional
Paper 1
Plant Diversity

Max. marks 40
Internal assessment 10
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 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit 1

Algae, Fungi and Lichen: Salient features, habitat, range of thallus structure, reproduction and broad classification of algae; General account, classification and reproduction in fungi; Brief account of Lichen and Mycorrhiza*;* Economic importance of algae, fungi and lichens.

Unit 2

Bryophytes and Pteridophytes: General characteristics, broad classification and reproduction in Bryophytes and Pteridophytes; Ecological and Economic importance of Bryophytes; Evolution of stelar system and seed habit in Pteridophytes

Unit 3

Gymnosperms: Salient features and diagnostic characters of; Distribution in India, Pteridospermic seeds and evolution of seed habit in gymnosperms, Economic Importance with reference to Wood, Resins, Essential oils and Drugs

Unit 4

Angiosperms and Taxonomy: Botanical nomenclature and Elementary knowledge of International Code of Botanical Nomenclature, Role of Herbaria and Botanical Gardens, Broad outline of Bentham & Hooker system of classification with merits and demerits

Max. Marks 50
Time: 03 hrs

PRACTICALS

Morphological studies through specimens, temporary mounts and permanent slides (Fresh material whichever available).

1. Fungi: *Rhizopus, Aspergillus, Yeast, Puccinia, Agaricus*
2. Algae: *Volvox, Spirogyra, Chara, Vaucheria, Polysiphonia, Ectocarpus*
3. Bryophytes: *Riccia, Marchantia, Anthoceros, Funaria, Sphagnum*
4. Pteridophytes: *Lycopodium, Selaginella, Equisetum, Marsilea, Pteris*
5. Gymnosperm: *Cycas, Pinus, Ephedra, Thuja, Cedrus*
6. Herbarium/museum specimens of the diseased plants: Black stem rust of Wheat, Late blight of Potato, Red rot of Sugarcane, Green year of Bajra
7. Familiarity with local flora and herbarium techniques.
8. **Field Excursion:** Visit to any Botanical or Medicinal Plant Garden
9. **Field Records:** Field note-book and 20 herbarium sheets of common angiospermic weeds are to be prepared and submitted at the time of Practical Examination.

SUGGESTED READINGS

Lee, R.E. 2008. Phycology, Fourth Edition, Cambridge University Press, USA.
Bilgrami, K.S. and Saha, L.C., 2001, *A Text Book of Algae,* CBS Publishers, New Delhi.
Kumar, H.D. 1999. Introductory Phycology. East-west Press Pvt ltd., Delhi.
Alexopolous, C.J. , Mims, C.W. and Blackwell, M. (1996), *Introductory Mycology,* John Wiley and Sons, New York.
Bold, H.C. & Wayne, M.J. 1996 (2nd Ed.) Introduction to Algae.
Shaw, A.J. and Goffinet, B. (2000) Bryophyte Biology. Cambridge University Press.
Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.
Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
Bhatnager, S.P. and Moitra, A. (1996) Gymnospersm. New Age International (P) Ltd. Publishers, New Delhi.
Simpson, M.C. (2006). Plant Systematics. Elsevier, Amsterdam.
Stussy, T.F. 1990. Plant Taxonomy, Columbia University Press, USA.39
Rashid, A., 1992, *An Introduction to Pteridophytes,* Vikas Publishing House Pvt. Ltd., New Delhi
Davis, P.H. and Heywood, V.H., 1965, *Principles of Angiosperm Taxonomy,* Oliver and Boyd, Edinburgh.
Naik, V.N., 1984, *Taxonomy of Angiosperms,* Tata McGraw- Hill, New Delhi.
sidiary syllabus

.Sc Chemistry (Hons.) IInd Sem.
Botany Optional
PAPER I1
PLANT PHYSIOLOGY AND METABOLISM

Max. marks 40
Internal assessment 10
\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 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit 1

Plant-water relations: Concept of osmosis, diffusion, imbibition and water potential; Soil-plant-atmosphere continuum concept, concepts of symplast and apoplast; ascent of sap; transpiration and antitranspirants; mechanism of opening and closing of stomata, Mineral nutrition, Translocation of photoassimilates.

Unit 2

Photosynthesis: Photosynthetic pigments; Photosystems; Cyclic and noncyclic electron transport; photophosphorylation.Carbon fixation in C_3 and C_4 plants, CAM plants, factors affecting photosynthesis

Respiration: Glycolysis; the TCA cycle and its regulation; electron transport in mitochondria; oxidative phosphorylation

Unit 3

Carbohydrate Metabolism: Structure, properties and importance of mono-, di- and polysaccharides; Synthesis of sucrose, starch and cellulose. **Nitrogen Metabolism :** Biological nitrogen fixation and nitrogen cycle **Lipid Metabolism:** Structure, properties, classification and functional significance of fatty acids, triglycerides and steroids; Synthesis and breakdown, formation of glycerides; oxidation of fatty acids, beta oxidation; energy balance.

Unit 4

Flowering; physiological definition; role of light; photoperiodism, inductive and non-inductive cycles; role of dark period; role of quality and intensity of light; nature of the flowering stimulus; florigen concept, vernalization: mechanism.
Structure, biosynthesis, analysis, transport, physiological effects and mechanism of action of growth regulators.

Max. Marks 50
Time: 03 hrs

PRACTICALS

1. Preparation of solutions of various concentrations of a few selected solutes.
2. Determination of osmotic potential of plant cell sap by plasmolytic method.
3. Determine water potential of given tissue by weight method and falling drop method.
4. Study of the effect of various environmental factors on transpiration in an excised twig/leaf.
5. Calculation of the stomatal index, stomatal frequency and percentage of leaf area open through stomata in a mesophyte and a xerophyte.
6. Study of the mechanism of stomatal opening and closing
7. Bolting experiment / *Avena* coleoptiles bioassay.
8. Study the effect of different factors on O_2 evolution during photosynthesis and demonstrate the Law of limiting factors.
9. Chemical separation of chloroplast pigments and determination of their absorption spectra.
10. To extract anthocyanin pigments and study the effect of pH on their absorption spectra.
11. Study of the rate of aerobic respiration and respiratory quotient in different plant parts/materials.
12. Identification tests for carbohydrates (Fehling's test, Benedicts test) and proteins (Ninhydrin test, Xanthoproteic test).
13. Preparation of standard curve for estimation of proteins and determination of total proteins in plant tissue extracts for example of control and GA_3 treated embryo-less wheat grains.

Projects: Students are required to perform at least one long-duration experiment as project (a

suggestive list of experiments will be provided).

SUGGESTED READINGS

1. opkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
2. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.
3. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.
4. Taiz, L. and Zeiger, E. (2006) Plant Physiology, 4th Edition, Sinauer Associates Inc .MA, USA 41
5. Dennis, D.T., Layzell, D.B., Lefebre, D.D. and Turpin, D.H. (1997) Plant Metabolism. Addison Wesley Longman.

B.Sc Chemistry (Hons.) IIIrd Sem.
Botany Optional
Paper III
Plant Anatomy, Reproduction and Biotechnology

Max. marks 40
Internal assessment 10
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 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit 1

Plant Anatomy: Classification and structure of tissues; Organization of root and shoot apex; basic structure of dicot and monocot leaf; secondary growth in roots and stems; Anatomical adaptations of hydrophytes and xerophytes; Anomalous secondary growth in *Boerhaavia, Tecoma* and *Dracaena*; Applications of anatomy in systematics, forensics and pharmacognosy

Unit 2

Plant reproduction: Structure of male and female gametophyte; mircrosporogenesis and megasporogenesis, Pollination and fertilization; pollen-pistil Interaction; self incompatibility and methods to overcome self incompatibility; endosperm types and functions; embryogenesis and polyembryony

Unit 3

Plant tissue culture: Historical perspective; composition of media; totipotency; physic-chemical conditions for propagation of plant cells and tissues; somatic embryogenesis; protoplast isolation, culture and fusion; cybrids; micropropagation; methods and significance of haploid culture

Unit 4

Plant Genetic Engineering: Brief concept of different gene transfer methods, special emphasis on *Agrobacterium* mediated gene transfer, Role of Plant Biotechnology in crop improvement with special reference to transgenic plants and genetically modified food, Application of plant biotechnology for production of quality oil, industrial enzymes and edible vaccines

Max. Marks 50
Time: 03 hrs

PRACTICALS

1. Understanding of staining technique for preparation of permanent slides
2. Preparation of temporary and permanent slides of T.S. of available root and stem (any four)
3. Study of anomalous secondary structure in stem of *Boerhaavia, Tecoma* and *Dracaena.*
4. To study ecological adaptations in locally available hydrophytes and xerophytes.
5. Studies of different anthers, pollen grains, ovule and endosperm from permanent slides/photographs
6. Pollen germination: in different media and calculation of percentage germination.
7. Acquaintance with laboratory instruments - Autoclave, Incubator, Clinical centrifuge, Analytical balance, pH Meter, Colorimeter, Water bath, Distillation plant.
8. Preparation of MS media, aseptic culture of different explants, methods of *in vitro* sterilization, inoculation and subculture methods

9. SUGGESTED READINGS

1. Dickinson, W.C. (2000) Integrative Plant Anatomy. Harcourt Academic Press, USA
2. Fahn, A., 1990, *Plant Anatomy*, Pergamon Press, Oxford.
3. Raghavan, V. (2000) Developmental Biology of Flowering plants, Springer, Netherlands.
4. Bhojwani, S.S. and Bhatnagar SP (2004) The Embryology of Angiosperms, Vikas Publishing House
5. Shivanna, K.R. (2003) Pollen Biology and Biotechnology, Science Publishers.
6. Bhojwani, S.S. and Razdan (2004) Plant Tissue Culture and Practice. Smith, R.H., 2000, *Plant Tissue Culture, Technique and Experiments*, Academic Press, New York.
7. Slater, A., Scott, N.W. & Fowler, M.R. (2008) Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press

B.Sc Chemistry (Hons.) IVth Sem.
Botany Optional
PAPER IV
ECONOMIC BOTANY

Max. marks 40
Internal assessment 10
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 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit - I

Origin of Cultivated Plants

Concept of centres of origin, their importance with reference to Vavilov's work; examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of weeds in germplasm diversity.

Unit 2

Botany, cultivation and uses of:
1) **Food crops**: Wheat and Rice.
2) **Vegetable crops**: Potato, tomato and chillies
3) **Legumes**: General account, importance to man and ecosystem; chief pulses grown in India.

Unit 3

Spices: Listing of important spices, their family and part used; with special reference to black pepper, turmeric, fennel, clove, saffron; common adulterants of spices.

Beverages: Tea and coffee, their processing and some common adulterants.

Unit 4

Ethnobotany: Introduction; Role of ethnobotany in conservation of indigenous plant wealth; Role of ethnobotany in drug discovery; Traditional Knowledge and IPR issues.

Medicinal plants: Distribution, description and uses of *Aloe, Azadirachta, Commifora, Emblica, Rauwolfia, Withania, Andrographis*

Max. Marks 50
Time: 03 hrs

Practical:

Observation of weeds with reference to Botanical Name, Family, Morphological and Ecological peculiarities.
Collection and submission of important spices used in local community.
Analysis of ethnobotanical data disease-wise, plant part wise, habit-wise and pictorial presentation of these data.
Collection of some important medicinal plants on folklore information and preparation of herbarium (minimum 10 species)
Submission of Ethnomedicinal herbarium /Museum specimens like leaves, barks, tubers, nuts, etc. of economic/medicinal use.

In the Practical, students should also be shown a few standing crops under field conditions wherever possible and to aware them about constraints faced by the farming community for increasing crop productivity. This could be integrated with the project reports that students have to submit.

Students should also be made to understand India's productivity status for various economically important plants in relation to that of other countries and their economic ramifications.

Suggested Readings

Kochhar, S.L. (2009) Economic Botany in Tropic. Macmillan and Co. New Delhi.

Wickens, G.E. (2004) Economic Botany: Principles and Practices, Springer. Klwer Publishers, Dordrecht, The Netherlands.

Colton, C.M. (1997). Ethnobotany – Principles and applications. John Wiley and sons – Chichester

Balick, M.J. & Cox, P.A. 1996. Plants, People and Culture - The Science of Ethnobotany. Scientific American Library, New York.

Chrispeels, M.J. and Sadava, D.E. (1994). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Jain, S.K. (1995) Manual of Ethnobotany, Scientific Publishers, Jodhpur,

B.Sc. Chemistry (Hons) Ist Sem.
Statistics Optional
Paper-I

Statistical Methods-I

Max. Marks: 40
Internal Assessment: 10
Time: 3 hrs.

Note: Examiner will set 08 questions, 04 from each section and candidate will be required to attempt five questions in all selecting atleast two question from each section. All questions will carry equal marks**.**

Section I (4 Questions)

Primary & Secondary Data, Qualitative & Quantitative Data, Discrete & Continuous Data, Frequency & Non-frequency Data, Classification & Tabulation of Data, Diagrammatic & Graphical Presentation of Data, Histograms, Frequency Polygon, Frequency Curve & ogives

Measures of Central Tendency: Mean, Median, Mode, Quartiles, Deciles & Percentiles

Measures of dispersion: Range, Quartile Deviation, mean Deviation, Standard Deviation Root Mean Square Deviation coefficient of variation

Section II (4 Questions)

Basic terms used in probability, Definition of probability. Addition and multiplication laws of probability, Bayes theorem and its applications Random variable, probability mass and density functions, distribution functions Mathematical Expectation, Addition and Multiplication theorem of expectation, Moments, Skewness and Kurtosis, Effect of change of origin and Scale on moments, moments Generating functions

Books suggested:

Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I & II
Mood, A.M. and Graybill, F.A.: Introduction to the theory of Statistics
Hogg, R.V. & A. T. Craig: Introduction to Mathematical Statistics.
Meyer, P.L.: Introductory Probability and Statistical Applications

Max. Marks : 50
Time: 3 hrs.

Paper I (Practical)

To collect, classify and tabulate some primary data.

To construct frequency distribution using exclusive and inclusive methods and representation of data using Histogram, Frequency polygon, frequency curve and Ogives.

To represent data diagrammatically using bars and pie diagrams.

To compute various measures of central tendency and dispersion.

To compute various measures of dispersion.

To obtain moments about any point & about mean.

To obtain coefficients of skweness and kurtosis.

B.Sc. Chemistry (Hons) IInd Sem.

Statistics Optional

Paper-II

Statistical Methods-II

Max. Marks: 40
Internal Assessment: 10
Time: 3 hrs

Note: Examiner will set 08 questions, 04 from each section and candidate will be required to attempt five questions in all selecting atleast two question from each section. All questions will carry equal marks

Section I (4 Questions)

Concept and types of correlation, scatter diagram, Kart Pearson's is coefficient of correlation (r) Properties of (r), Rank correlation coefficient, limits of rank correlation, tied or repeated ranks
Concept of regression, principal of least squares and fitting of straight line, second degree parabola and curves of the type $У=ab^{x,}$ $У=ax^{b}$ $У=ae^{bx}$, derivation of two lines of regression, properties of regression coefficients, distinction between correlation and regression, angle between two lines of regression.

Section II (4 Questions)

Bernoullie distribution, Binomial distribution, moments, moments generating function, additive property, characteristic function, Poisson distribution, moments, moment generating function, characteristic function, additive property of independent Poisson variates , Numerical problems based on Binomial and Poisson distribution, continuous uniform distribution, moments, moment generating function of normal distribution, chief characteristics of normal distribution, linear combination of independent normal variates, Area property of normal distribution and related numerical problems.

Books suggested:

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I & II
2. Hogg, R.V. & A. T. Craig: Introduction to Mathematical Statistics.
3. Freund, J. E, Mathematical Statistics
4. Mukho Padhayaya, P: Mathematical Statistics

Max. Marks : 50
Time: 3 hrs.

Paper II (Practical)

To compute Karl-Pearson's coefficients of correlation for a Bivariate frequency distributions.

To find Spearman rank coefficient for the given data on two variables.

To fit straight line and second degree parabola.

To fit the curve of the types (i) $Y=a^{xb}$ (ii) $Y=a^{bx}$ (iii) $Y=ae^{bx}$

To obtain regression of a Bivariate frequency distribution.

To fit binomial distribution and Poisson distribution to the given data.

Area under normal probability curve.

B.Sc. Chemistry (Hons) IIIrd Sem.
Statistics Optional
Paper-III

Elementary Interface

Max. Marks: 40
Internal Assessment: 10
Time: 3 hrs

Note: Examiner will set 08 questions, 04 from each section and candidate will be required to attempt five questions in all selecting atleast two question from each section. All questions will carry equal marks

Section –I (4 Questions)

Parameter and statistic, sampling distribution of statistic. Point estimate of a parameter, concept of bias and standard error of an estimate. Standard error of sample mean, proportion, standard deviation, Unbiased ness, Efficiency, Consistency and Sufficiency. Null and alternative hypotheses. Simple and composite hypotheses, critical region, level of significance, one tailed and two tailed testing, Types of errors, testing of sample mean and proportion and difference of two means and of two proportions. Fisher's Z transformation.

Section II (4 Questions)

Chi-Square distribution and its properties. Applications of Chi-Square test. Definition of student's 't' and Fisher's 't'. Constants of t-distribution, Definition of Snedecor's F-Distribution, constants of F-distribution, testing for the mean and variance of univariate normal distribution testing the equality of two means and equality of two variances of univariate normal distributions, Numerical problems based on T and F.

Books suggested:

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I & II
2. Hogg, R.V. & A. T. Craig: Introduction to Mathematical Statistics.
3. Freund, J. E, Mathematical Statistics
4. Mukho Padhayaya, P: Mathematical Statistics

Max. Marks : 50
Time: 3 hrs.

Paper III (Practical)

1. To apply large sample test of significance for single proportion and difference of two proportions and obtain their confidence intervals.
2. To apply large sample test of significance for single mean.
3. To apply large sample test of significance for difference between two means and standard deviations.
4. To apply t-test for testing single mean and difference between means and to obtain their confidence intervals.
5. To apply paired t-test for difference between two means.
6. To apply Chi-square test for goodness of fit and independence of attributes.
7. To apply f-test for testing difference of two variances.

B.Sc. Chemistry (Hons) IVth Sem.
Statistics Optional
Paper-IV

Sampling Techniques and Design of Experiments

Max. Marks: 40
Internal Assessment: 10
Time: 3 hrs

Note: Examiner will set 08 questions, 04 from each section and candidate will be required to attempt five questions in all selecting atleast two question from each section. All questions will carry Equal marks.

Section I (4 Questions)

Concepts of census and sample survey, basic concepts in sampling. Sampling and Non-sampling errors. Principal steps involved in a sample survey: bias, precision and accuracy and mean squared errors, simple random sampling (SRS) with and without replacement. Use of random number tables, estimator of mean and its variance in case of simple random sampling. Stratified random sampling estimation of population mean and its variance of sample size, proportional allocation, and optimum allocation.

Section II (4 Questions)

Introduction to design of experiment, terminology, Experiment, treatment, experimental unit, blocks, experimental error, replication, precision, efficiency of a design, need for design of experiments, size and shape of plots and blocks. Fundamental principles of design, randomization, replication and local control, completely randomized design, critical difference and Duncan's Test, randomized Block Design, their layout, statistical analysis, applications, advantages and dis-advantages and Latin square design (LSD), standard, layout of LSD, its statistical analysis, applications, merits and demerits. 2^2 factorial experiment.

Books suggested:

Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I & II
Daroga Singh & F. S. Chaudhary: Theory and Analysis of Sample Surveys

Max. Marks : 50
Time: 3 hrs

Paper IV (Practical)

Enumerate all possible samples of size 2 from a population of 5 households by:

Replacement method

Without replacement

Show the unbiasedness of sample mean & find its variance.

To estimate population total from the given sampled data and obtain confidence interval for population total.

To divide the given population into two/three strata and then selecting sample of given size, find the S.E. of estimate of population total for:

(a) Stratified sampling with proportional allocation

(b) Stratified sampling with optimum allocation.

To perform ANOVA in case of CRD and test whether the treatments/varieties are equally effective.

Apply Duncan's test to find significantly different treatments and also find that the treatments are significantly different using critical difference.

For an RBD construct an ANOVA table and test.

(c) Whether row effects are equal.

(d) Whether column effects are equal.

Perform ANOVA for an LSD and test whether the treatment/rows/columns effects are equal.

LITERATURE AND LANGUAGE-I

SEMESTER-I
SESSION 2011-2012

Paper -106
SCHEME OF EXAMINATION

Max. Marks	**50**
Theory	**40**
Internal Assessment	**10**
Time	**3 hrs.**

Part-A Poetry

The following poems from the Chronicles of Time edited by Asha Kadyan (Oxford University Press)

a) "Let Me Not to the Marriage of True Minds" by William Shakespeare
b) "Death Be Not Proud" by John Donne
c) "On His Blindness" by John Milton
d) "Shadwell" by John Dryden
e) "Know Then Thyself" by Alexander Pope
f) "The Little Black Boy" by William Blake
g) "Three Years She Grew in Sun and Shower" by William Wordsworth

Part-B Phonetics and Grammar

Phonetics: Introduction to the Sound System of English: Phonetics Symbols, Organs of Speech, Transcription of Words (oxford Advance Learners' Dictionary by Hornby to be followed).
Grammar: Parts of speech, Types of Sentences, Common Errors, Technical Writing (application writing, business letter)

Instructions for the paper setter and the students

Q. NO.1 Explanation with reference to the context. The students will be required to attempt two passages out of the given four from the book of poems. **4x2=08**

QNO.2 Two questions (with internal choice) will be asked based on theme central idea, Message and narrative technique of the poem **4x2=08**

QNo.3 The question will be based on the Sound System of English language having internal choice **08**

Q No.4 The question will be based on grammar. There will be internal choice with 16 Sentences out of 24 to be attempted **08**

Q NO.5 The question will be based on technical writing. There will be internal choice **08**

LITERATURE AND LANGUAGE-II

SEMESTER-II
SESSION 2011-2012

Paper-206
SCHEME OF EXAMINATION

Max. Marks	**50**
Theory	**40**
Internal Assessment	**10**
Time	**3 hrs.**

Part-A Short Stories

The following Stories from the Pointed Vision: An Anthology of Short Stories by Usha Bande and Krishan Gopal (Oxford University Press, New Delhi)

1. 'The Bet' by Anton Chekhov
2. 'Gift of the Magi' by O Henry
3. 'The Postmaster' by Rabindranath Tagoreb
4. 'Three Questgions' by Leo Tolstoy.
5. 'The Dying Detective' by Arthur Conan Doyle.
6. 'Under the Banyan Tree' by R.K. Narayan.

Part-B (i) Grammar and Writing Skills

Synonyms and Antonyms
Prefix-Suffix
Homophones and Homonyms
One word substitution

(ii) a) Development writing skills through theme based paragraphs
b)Technical writing: E-mail writing, Reporting, Resume writing, Re-viewing T.V. Programes.

Instructions to the Paper Setter and the Students

Q.NO.1	Explaination with reference to the context. The students will be required to attempt two passages (with internal choice) from the book of stories. 4x2=8
Q.NO.2	Two essay type questions (with internal choice) will be asked from the book of Stories 4x2 =8
Q.No.3	This question will be based on grammar. Students will be required to attempt 16 sentences out of the given 24. =8
Q NO.4 &5	Question No. 4 & 5 will be based on writing skills and technical writing.

8x2=16