PAPER - 1
INORGANIC CHEMISTRY

1. Stereochemistry and Bonding in Main Group Compounds (12 hrs.)
VSEPR, Walsh diagram (triatomic and penta-atomic molecules), dribonds, Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.

2. Metal-Ligand Equilibrium in Solution (8 hrs.)
Stepwise and overall formation constants and their interaction, trends in stepwise constant, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand. Chelate effect and its thermodynamic origin, determination of binary formation constants by potentiometry and spectrophotometry.

3. Reaction Mechanism of Transition Metal Complexes (24 hrs.)
Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anion reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

4. Metal-Ligand bonding (15 hrs.)
Limitation of crystal field theory, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

5. Metal –Complexes (18 hrs.)
Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reaction of transition metal nitrosyl, dinitrogen and dioxgen complexes; tertiary phosphine as ligand.

6. Electronic Spectral & Magnetic Properties of Transition Metal Complexes (24 hrs.)

Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), Selection rule for electronic spectroscopy. Intensity of various type electronic transitions, Calculations of 10Dq, B and β parameters, charge transfer spectra. Anomalous magnetic moments, Quenching of Orbital contribution. Orbital contribution to magnetic moment, magnetic exchange coupling and spin crossover.

7. Metal Clusters (15 hrs.)

Higher boranes, carboranes, metalloboranes and metallo-carboranes compounds with metal metal multiple bonds.

8. Crown ether complexs and cryptands, inclusion compounds (3 hrs.)
9. Isopoly ether complexes and cryptants, incusion compounds (4 hrs.)
10 Symmetry and Group theory in Chemistry (12 hrs.)

Symmetry elements and symmetry operation, definition of group, subgroup., reaction between orders of a finite group and its sub-group, Conjugacy relation and classes. Point symmetry group. Schonfilies symbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy.

Books Suggested:

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetiochemistry, R.1. Carlin, Springer Verlag.
6. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty,Pergamon.
7. Chemical Applications of Group Theory, F.A. Cotton.

PAPER - II
ORGANIC CHEMISTRY

M.M. 100

1. Nature of Bonding in Organic Molecules (10 hrs)

Delocalized chemical bonding-conjugation, cross conjugation, resonance hyperconjugation, bonding in fullerences, tautomerism. Aromaticity in benzenoid and non-benzoid compounds, alternate and non-alternate hydrocarbons. Huckel's rule, energy. Level of π-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds, crown ether complexs and cryptands, inclusion compounds, catenanes and rotaxanes.

2. Stereochemistry (15 hrs)

Conformational analysis of cycloalkanes, decalins, effect of confermation of reactivity, confirmation of sugers, steric strain due to unavoidable crowding Elements of symmetry, chirality, molecules with more than one chiral center, threo and ertythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spirane chirallity due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

3. Reaction Mechanism : Structure and Reactivity (12 hrs)

Type of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtir-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotopes effects. Hard and Soft acids and bases. Effect of structure on reactivity resonance and field effects, steric effect, Hammett equation and linear free energy relationship, substitution and reaction constants.

4. Reaction intermediates: (10 hrs)

Generation, structure, stability and reactivity of carbocation~carbanions, free radicals, carbenes, Nitrenes, and Benzynes. Application of NMR in detection of carbocations.

5. Electrophillic Substitution reactions: (10 hrs)

(a) **Alipahatic.lectrophilic Eubstitution:** Bimolecular mechanism S_E2, S_Ei and S_El mechanism electrophilic substituion acompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.

(b) **Aromatic Electrophilic Substitution:** The treniumion mechanism, orientation and reactivity, energy profile diagrams. The ortholpara ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Gatterman-Koch reaction, Vilsmeir reactiion.

6. Nucleophilic Substitution reactions: (**15 hrs)**

(a) **Aliphatic nucleophilic substition:** The S_N2, S_N1 mixed S_N1 and S_N2 and SET mechanisms. The neighboring group mechanism, neighboring group participation by a and B bonds.
The S_Ni mechanism. Nucleophilic substitutior at an allylic aliphatic trigonal and at a vinylic carbon. Reactivity effects of substrate skucture, attacking nucleophile, leaving group and reaction medium, amoident nucleophile, regioselectivity.

(b) **Aromatic Nucleophilci Substitution:** The SNAr SN^1, benzyne and SN^1 mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richte. Sommelet-Hauser, and Smiles rearrangements.

7. Free Radical Reactions (8 hrs)

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity.
Allylic halogenation (NBS), oxidation of aldehydes to carboyxlic acids, autooxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

8. Addition to Carbon-Hetero Multiple bonds (7 hrs)

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acid esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and usaturated carbonyl compounds. Witting reaction. Mechanism of condensation reactions involving enolates-Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, Ammonolysis of esters.

9. Addition to Carbon Multiple bonds (12 hrs)

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bounds, hydrogenation of aromatic rings. Hydroboration, Michael reaction, sharpless asymmetric epoxidation.

10. Elimination Reactions (5 hrs)

The E_2, E_1 and E_{1cB} mechanisms and their spectrum. Orientation of the double bond. Reactitivty-effects of substrate structures, attacking base, the leavign group and the medium.

11. Molecular rearrangoment reaction: (11 hrs)

General mechanistlc approach to molecular rearrangement reactions, Carbocation rearrangement, Migratory aptitude and Memory effects. Brief study of following rearrangement reactions Pinacol-Pinacolone, Favoroskii, Baeyer-Villigers oxidattion, Stork enamine reaction, Sharpiro reaction, Michael addition, Sommelet rearrangement, Witting's rearrangement. Grovenstein-zimmerman rearrangement.

12. Pericyelic Reactions (20 hrs)

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of periycyclic reactions. Woodward-Hoffmann correlatino diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, 4n 4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotrpic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties, 3,3- and 5,5 sigmatropic rearrangements. Claise n, Cope and aza-Cope rearrangements. Fluxional tautomerism. Enereaction.

Book Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
6. Modern Organic Reactions, H.O. House, Benjamin.

7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professionsl.
8. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
9. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
10. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.
11. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International.

PAPER - III
PHYSICAL CHEMISTRY

M.M. 100

I- QUANTUM CHEMISTRY (30 hrs)

A. Introduction to Exact Quantum Mechanical Results

The Schrödinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrödinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom and helium atom.

B. Approximate Methods

The variation theorem, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.

C. Angular Momentum

Ordinary angular momentum, generalized angular momentum, eigenfucntions for angular momentum, eigenvalues of angular momentum operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

D. Electronic Structure of Atoms

Electronic configuration, Russell-Sauders terms and coupling schemes, Slater-Condon parameters, term Separation energies of the pn configuration, term separation energies for the D. configurations, magnetic effects spin-orbit coupling and Zeeman splitting, introduction to the methods of self-considstent field, the virial theorem.

E. Molecular Orbital Theory

Huckel theory of conjugated systems bond and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical cyclobutadiene etc. Introduction to extended Huckel theory.

II. THERMODYNAMICS (30 hrs)

A. Classical Thermodynamics

Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity.

Non-ideal systems: Excess function s for non-ideal solutions. Activity, activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transitions.

B. Statistical Thermodynamics

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition. Application of partition functions. Fermi-Dirac Statistics, distribution law and applications to metal. Bose-Einstein statistics distribution Law and application to helium.

C. Non Equilibrium Thermodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electro kinetic phenomena, diffusion, electric conduction, irreversible thermodynamics for biological system, coupled reactions.

III. CHEMICAL DYNAMICS (24 hrs)

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dynamic chain (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogenbromine and hydrogen-chlorine reactions) and homogenous catalysis, kinetics of enzyme reactions, general features fo fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis ad the nuclear magnetic resonance method, dynamics of unimolecular reactiosn (Lindemann Hinshelwood and Rice-Ramsperger-Kassel- Marcus (RRKM) theories for unimolecular reactions).

IV. SURFACE CHEMISTRY (20 hrs)

A. Adsorption

Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon) catalytic activity at surface.

B. Micelles

Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solublization, micro emulsion, reverse micelles.

C. Macromolecules

Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.

V. ELECTROCHEMISTRY (25 hrs)

Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces. Guoy-Chapman, Stern, Graham-Devanathan-Mottwatts, Tobin, Bockris, Devanlhan models.

Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot.

Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling

Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface

Electrocatalysis - influence of various parameters. Hydrogen electrode. Bioele. ctrochemistry, threshold membrane phEnomena, Nernst Planck equation, Hodges-Huxley equations, core conductor models, electrocardiography. Plarography theory iikovic equation; half wave potential and its significance Introduction to corrosion, homogenous theory forms of corrosion, corrosion monitoring and prevention methods.

VI. ELECTRON/DIFFRACTION (3 hrs)

Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces.

VII. NEUTRON DIFFRACTION (3 hrs)

Scattering of neutrons by solids and liquids, magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cells

Books Suggested:

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistyry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R.Mc Ween y, ELBS.
5. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
6. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
7. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
8. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
9. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.

SPECTROSCOPY, DIFFRACTION, METHOD'S COMPUTER'S BIOLOGY AND MATHEMATICS IN CHEMISTRY

The Fourth questation paper of M.Sc. Prev. chemistry shall compose of three sections viz. A, B, and C the formate of this paper shall be as under

SECTION – A
PAPER - IV
SPECTROSCOPY AND DIFFRACTION METHODS

1. Unifying Principles (10 hrs)

Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorption, emission transmission, reflection, dispersion, polarization and scattering, Uncertainty relation and natural line width and natural line broadening, transition probability, selection rules, intensity of spectral lines, Born-Oppenheimer approximation, rotational, vibrational and electronic energy levels.

2. Microwave Spectroscopy: (3 hrs)

Classification of molecules, rigid rotor model' effects of isotopic substitution on the transition frequencies, intensities, non rigid rotor, Slark effect, nuclear and electron spin interactions and effect of external field. Applications

3. Vibration Spectroscopy (15 hrs)

(a) **Infrared Spectroscopy** - Review of linear harmonic oscillator, vibrational energies of diatomic molecules zero point energy, force constant and bond strengths, anharmonicity, Morse potential energy diagram, vibrational-rotational spectroscopy P.Q.R. branches, breakdown of Oppenheimer approximation, vibrations of poly-atomic molecules. selection rules, normal modes of birations, group frequencies, overtones, hot bands, factors affecting the band position and intensities, far IR region, metal-ligand vibrations, normal co-ordinate analysis.

(b) **Raman Spectroscopy:** Classical and quantum theories of Raman effect, pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules mutual exclusion principle, Resonance Raman spectroscopy, Coherent anti Stokes Raman spectroscopy (CSRS).

4. Electronic Spectroscopy (12 hrs)

(a) **Atomic Spectroscopy** - Energies of atomic orbitals vector representation of momenta and vector coupling, spectra of hydrogen and alkali metal atoms.

(b) **Molecular Spectroscopy** - Energy levels, molecular orbitals, vibrational transitions, vibrational progressions and geometry of the excited states, Frank-Condon principle, electronic spectra of poly-atomic molecules, emission spectra, radiative and non radiative decay, internal conversion, spectra of transition metal complexes, charge transfer spectra,

(c) **Photo Electron Spectroscopy** - Basic principles, Photo-electric effect, ionzation process, Koopman's theorem, Photo-electron spectra of Simple molecules., ESCA, Chemical information fom ESCA, Auger Electron Spectroscopy (basic idea)

5. Megnetic Resonance Spectroscopy (20 hrs)

(a) **Nuclear Magnetic Resonance Spectroscopy:** Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors, influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.). spin decoupling; basic ideas about instrument, NMR studies of nuclei other than protin-13C, 19F and 31P. FT NMR, advantages of FT NMR, use of NMR in medical diagnostics.

(b) **Electron Spin Resonance Spectroscopy:** Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications.

(c) **Nuclear Quadrupole Resonance Spectroscopy:** Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting. Applications

6. Photo-acoustic Spectroscopy (3 hrs)

Basic Principles of Photo-acoustic Spectroscopy (PAS), PAS gases and condensed systems, chemical and surface applications.

7. X-ray Diffraction (12 hrs)

Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules, Ramcharan diagram.

SECTION – B
PAPER - IV
COMPUTERS IN CHEMISTRY

Two questions shall apper in question paper from this section and examinees shall answer one question.

8. Induction to Computer and Computer Programming in 'C' (15 hrs)

(a) Computer Fundamentals- Introduction to Computer organization, Operating Systems, DOS, Introduction to UNIX and Windows, Computer languages, principles of programming, Algorithm and flow chart.

(b) Programming in 'C'- Structlre of a 'C' programme, constants, variables, operators and expressions, data input and output, decision making, branching and looping, statements, arrays, user defined functions, pointers, structures and unions.

9. Programming in Chemistry and use of Computer programmes (15 hrs)

(i) Development of small computer codes involving simple formulas in Chemistry such as vender Wall equation, pH titrations, Kinetics, Radioactive decay, evolutionm of lattice energy and ionic radii, Secular equation (within Huckel Theory) Elementary structural features such as bond length, bond angles, di-hederal angles etc. of molecule extracted from a data base such as Cambridge data base.

(ii) Introduction and use of computer packages like MS Word and Excel, preparation of graphs and chart.

SECTION - C
BIOLOGY, MATHEMATICS FOR CHEMISTS

The question paper shall contain two questions from 'Biology for chemists' part of this section and two questions from ''Mathematics for chemists part of this section. In all there will be four questions in this section of question paper. The examiners shall answer any one question out four.

10 (a) Carbohydrates (8 hrs)

Conformation of mono saccharides, structure and functions of important derivatives of mono-saccharides like glycosides, deoxy sugars, myoinositol, amino sugars. Nacetylmuramic acid, sialic acid disaccharides and polysaccharides. Structural polysaccharides cellulose and chitin. Storage polysaccharides-starch and glycogen. Structure and biological function of glucosaminoglycans of mucopolysaccharides. Carbohydrates of glycoporteins and glycolipids. Role of sugars in biological recognition. Blood group substances. Ascorbic acid.

Carbohydrate metabolism - Kreb's cycle, glycolysis, glycogenesis and glycogenotysis, gluconeogenesis, pentose phosphate pathway.

10 (b) Lipid (6 hrs)

Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Liproproteins-compositiion and function, role in atherosclerosis. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism-boxidation of fatty acids.

10 (c) Nucleic Acids (5 hrs)

Purine and pyrimidine bases of nucleic acids, base pairing via Hbounding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and trinucleoside.

11 (a) Vectors and Vector Algebra (6 hrs)

Vectors, dot, cross and triple products etc. The gradient, divergence and curl, Vector Calculus, Gauss' theorem, divergence theoram etc.

11 (b) Differential Calculus (6 hrs)

Functions, continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc.). Exact and inexact differential with their applications to the thermodynamics.

11 (c) Integral calculus (6 hrs)

Basic rules for integration, integration by parts, partial fractions and substitution. Reduction formulae. Applications of integral calculus to the problems related to chemistry.

Functions of several variables, partial differentiation, co-ordinate transformations (e.g. Cartesian to spherical polar), curve sketching.

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Viley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
6. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
7. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford.
8. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
9. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, harper & Row.

Books suggested

1. The chemistry Mathematics Book, E. Steiner, Oxford University Press.
2. Mathematical for Physical chemistry: F. Daniels, Mc. Graw Hill.
3. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall.
4. Chemical Mathematics D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry - J.R. Banainte, Prentice Hall.
6. Basis Mathematics for Chemists - Tebbltt;' Wiley.

Books suggested

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, J. David Rawan, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outines of Biochemistry - E.E. Conn and PK Stumpf, lohn Wilet