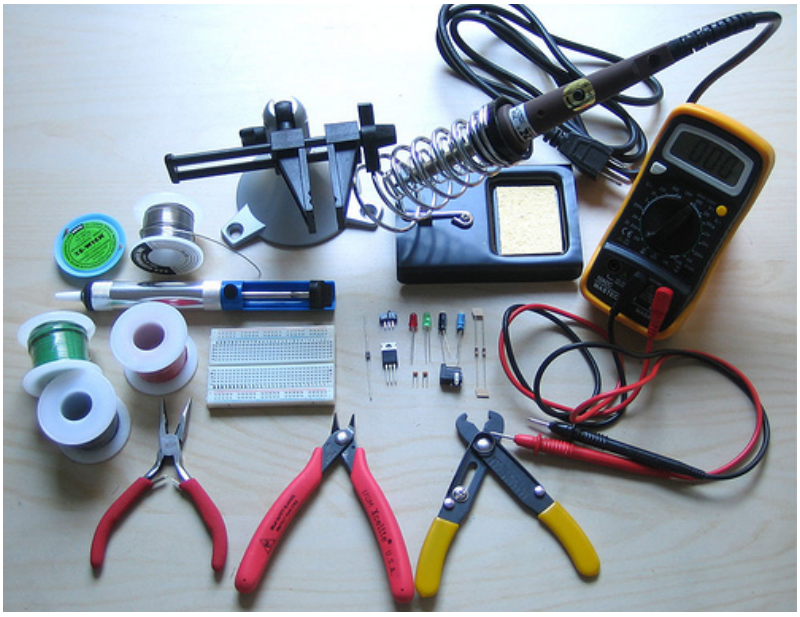
BABA FARID GROUP OF INSTITUTIONS

DEPARTMENT OF ELECTRONICS



"Electronics is one of the largest and fastest growing field. It covers a wide range of applications which make our life easier and enjoyable such as Television, Radio, Computers, Telecommunication etc. They help us to see, hear and communicate over vast distances and do things faster. Electronics has a major role in improving productivity in industries like oil, energy, agriculture and so many other important sectors of economy. In steel, petroleum and chemical industries it is the electronic devices that direct, control and test production processes. Health care industry depend on electronic instruments to perform chemical tests and to check body functions. The safety in transportation, factories and mines and in homes relies heavily on electronics. The uses are endless. You must find new solutions to the practical problems affecting our daily lives. You may team with other specialists to design, fabricate, produce, test and supervise the manufacture of complex products and systems i.e electronic equipments and components for a number of industries including hospitals, computer industry, electronic data processing systems for communication and in defense etc after completion of course. Electronics is a constantly changing and widening branch among profession courses."

--Dr. Subhash Pokhriyal
In-Charge
Department of Electronics

SYLLABUS OF B.Sc. (ELECTRONICS)-1st Year

PHYSICS PAPER 1-MECHANICS AND PROPERTIES OF MATTER

UNIT -1: Vectors

Tripple product of vectors, Scalar and vector fields, differentiation of vectors(Line surface and volume integration), application of vectors to linear and rotational quantities, Del operator, gradient, divergence and curl of vectors, circular motion , Guass's , stoke's and Green's theorems.

UNIT-2: Gravitational Fields and Potential

Law of gravitation, Gravitational Fields and potential, gravitational potential energy, escape velocity, gravitational field intensity and potential for spherical shell, Solid sphere and circular disc, Guass's and Poisson's equation for gravitational self energy. Universal square law forces, Keplar law of planetary motion.

UNIT-3: Conservation Law

Concept of inertial and non inertial frame of reference, work, energy principle, conservative forces, conservative forces as the negative gradient of potential energy. Law of conservation of total energy and momentum. Center of MASS, motion of center of mass, system of variable mass, The rocket, Conservation of angular momentum.

UNIT-4: Dynamics of rigid bodies

Equation of motion, angular momentum vector, moment of inertia, Theorem of parallel and perpendicular axis, moment of rod, rectangular lamina, circular lamina, solid sphere, spherical shell, and cylinder, kinetic energy of rotation, rolling along a slope, torque and precession, compound pendulum.

UNIT-5: Properties of Matter

Interaction between elastic constant, torsion of a cylinder, bending of beam, cantilever, shape of girders, Viscosity, Stoke's law, Posieille's formula, capilleries in series and parallel. Equation of continuity, Burnoulli's Theorem, surface tension, molecular interpretation.

PHYSICS PAPER 2-ELECTRICITY AND MAGNETISM

UNIT-1: Electric Field and Potential

Guass theory, its integral and differential forms, Line integral of electric field, Electric Field and Potential due to an arbitrary charge distribution, long charged wire, sphere, disc and dipole, electrostatic energy, energy stored in an electric field, method of electric image and its application for system of point charge near a grounded conducting plane surface.

UNIT-2: Electric Field in Matter

Dielectric, polar and non-polar molecule, polarization vector, electric displacement vector, three electric vectors, dielectric, susceptibility and permittivity, atomic and ionic polarization, electronic polarizability, Clausius –Mossotti relation, Langevin's theory of polar dielectrics, moment of charge distribution.

UNIT-3: Magnetostatics

Lorentz force, Bio-savert's law, Ampere's law, Application of Bio-savert law, magnetic field due to steady current in a long straight wire, Interaction between two parallel long current carrying wires, Fields due to Helmholtz coil, solenoid and a current loop, magnetic vector potential, permeability, Energy stored in magnetic fields, Ballastic galvanometer.

UNIT-4: Electric Currents

Current density, equation of continuity, ohm's law and electrical conductivity, Lorentzdrude theory, Wiedman-Frenz law, kirchoff's law's and their application, Transient currents, Growth and Decay of D.C. in L.R. and L.C. circuit, charging and discharging of capacitor through a resistance.

UNIT-5: Alternating Currents

Impedance, admittance and reactance, R-C, R-L and L-C circuits with alternating e.m.f. source, series and parallel L-C-R circuits, resonance and sharpness, quality factors, Power in A.C. circuits, Choke coil.

PHYSICS PAPER III-ACOUSTICS, WAVES AND OSCILLATION

Unit – I Simple Harmonic Motion

Characteristics of SHM, SHM in mechanical and electrical systems, Addition of SHM(s), Non-linear (an harmonic) oscillator, damped harmonic oscillator, Quality factor, application in moving coil galvanometer, oscillator of a system with two degree of freedom, lisshajous figures, Composition of two SHM(s) of frequency ratio 2:1.

Unit – II forced Oscillations and Resonance

Forced oscillations in mechanical and electrical systems, Transient and steady state behavior, phenomenon of resonance, sharpness of resonance, energy dissipation, Driven harmonic oscillator, velocity resonance.

Unit – III Wave Motion

Characteristics, Differential equation of a wave motion, principle of superposition, Beats, stationary waves, Wave velocity and group velocity, Fourier theorem, Fourier analysis of square wave, saw tooth and triangular wave.

Unit – IV Ultrasonic and Acoustics

Generations of ultrasonic waves, their detector and application, Peizo-electric effect and Quartz crystal, energy density of acoustic waves, Acoustic intensity, Measurement of acoustics intensity-dB scale. Reflection and transmission of acoustic waves at a boundary between two media, Acoustic of buildings , reverberation time , subime's formula, principle of Sonar system.

Unit – V Electromagnetic Waves

Maxwell's equations (derivation), Poynting vector, electromagnetic waves in free space and in conducting and non-conducting medium (dialectics), Elementary idea of reflection and refraction of E.M waves

CHEMISTRY PAPER -1: INORGANIC CHEMISTRY

1.Atomic structure

Idea of de Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schordinger wave equation, significance of psi and psi square, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s,p,d orbitals,Aufbau and Pauli's exclusion principles, Hund's multiplicity rule, electronic configuration of the elements, effective nuclear charge.

2.Periodic properties

Atomic and ionic radii, ionization energy,electron affinity and electron negativity-definition, methods of determination or evaluation, trends in periodic table and application in predicting and explaning the chemical behavior.

3.Chemical bonding

a. covalent bond – valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions, valence shell electron pair repultion theory to NH2,H3O+,S4F,CI3,FI,CI and H2o.MO theory, homonuclear and heteronuclear(CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and bond energy, percentage ionic character from dipole moment and electronegativity difference.

b.Ionic solids- ionic structures , radius ratio effects and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born –Haber cycle, salvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule, metallic bond-fee electron, valence bond and band theories.

c. weak interactions- hydrogen bonding , van der waal forces.

4.s- block elements

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

5. p-block elements

Comparative study (including diagonal relationships) of group 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16, hydrides of boron-diborane borazines,

borohydrides, carbides, fluorocarbons, tetrasulfur, tetranitrides, basic properties of halogens, interhalogens and poly halides

6. Chemistry of noble gases

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

7. Metallurgical processes

Minerals and ores, general metallurgical operations viz. concentration of ores, calcinations , roasting, smelting, slag and flux, extraction and refining of metals, chemistry of extraction and isolation of lithium and beryllium.

CHEMISTRY PAPER-II: ORGANIC CHEMISTRY

1. Structure and bonding

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

2. Mechanism of organic reactions

Curved arrow notation, drawing electronic movements with arrows, half headed and double headed arrows, hemolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates – carbocations and carbonions , free radicals, carbenes , arynes and nitrenes(with examples). Assigning for mal charges on intermediates and other ionic species. Methods of determination of reaction mechanism(product analysis, intermediate, isotopic effects, kinetic and stereochemical studies).

3. Stereochemistry of organic compounds.

Concept of isomerism. Types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers , stereogenic centers, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, distereomers, threo and erythro distereomers, meso compounds, resolution of enantiomers, inversion retention and racemisation, relative and absolute configuration, sequence rules,D&L and R&S systems of nomenclature. Geometric isomerisation- determination of configuration of geometrical isomers, E & Z System of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism-conformational analysis of ethane and n-butane, conformations of cyclohexane derivatives. NEWMAN PROJECTION AND SAWHORSE FORMULAE, Fischer and flying wedge formulae. Difference between configuration and conformation.

4. Alkanes and cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, alkyl groups, classification of carbon atoms in alkanes. Isomerism in alkanes, sources , methods of formation(with special reference to Wurtz reaction, Kolbe reaction,Corey- Gouse reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes. Mechanism of free radical halogenations of alkanes: orientation, reactivity and selectivity.

Cycloalkanes- nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain of small rings(cyclopropanes and cyclobutane). Theory of srainless rings, the case of cyclopropane ring – bananabonds.

5. Alkanes, cycloalkanes dienes and alkynes.

Nomenclature of alkenes, methods of formation, mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides, regeoselectivity in alcohol dehydration. The Saytzeff rule, Hoffmann elimination.Physical properties and relative stability of alkenes

Chemical reactions of alkenes-mechanism involved in hydrogenation, electrophilic and free radical aditions,Markownikoff's rule, hydroboration oxidation, oxymercuration reduction, Expoxidation, ozonolysis, hydration, hydroxylation and oxidation with KMnO4 Polymerization of alkenes. Subsitution at the alsylic and vinylic positions of alkenes. Industrial applications of ethylene and propane.

Methods of formation, confermation and chemical reaction of cycloalkenes. Nomenclature and classification of dienes: isolated, conjugate 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 alkenes: Methods of formation. Chemical reaction of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reaction, Hydroboration-oxidation, metal- ammonia reduction, oxidation and polymerization.

6. Arenes and Aromaticity

Nomeclature of benzene derivaties. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kukele structure. Stability and carbon-carbon bond length of benzene, resonance structure, MO picture. Aromaticity-the-Huckel rule, aromatic ions.

Aromatic electrophilic substitution-general pattern of the mechanism, role of and complexes. Mechanism π complexes. Mechanism of nitration, halogenations, sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagrams. Activating and deactivating substitutens, orientation and ortho/para ratio. Side chain reactions of benzene derivaties. Birch reduction.

Method of formation and chemical reaction of alkylbenezenes, alkynylbenzenes and biphenyl.

7. Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanism of nuclephilic substitution reaction of alkyl halides, Sn2 and Sn1 reactions with energy profile diagrams.

Polyhalogen compounds-chloroform, carbon tetrachloride.

Methods of formation of aryl halides, nuclear and side chain reaction. The additional elimination and the elimination addition mechanism of nucleuphilic aromatic substitution reactions.

Relative reactivities of allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

CHEMISTRY PAPER –III : PHYSICAL CHEMISTRY

Gaseous States

Postulate of kinetic theory of gases, deviation from ideal behaviour, vander waals equation of state. Critical phenomena-PV isotherms of real gases, continuity of states, the isotherms of vander waals equation, relationship between critical constant and vander waals constants, the law of corresponding states, reduced equation of state. Moleculer velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of moleculer velocities, collision number, means free path and collision diameter. Liquification of gases(based on Joule Thomson effect).

Liquid State

Intermolecular forces, structure of liquids(a qualitative description). Structure of liquids and gases. Physical properties of liquids including their methods of determination(surface tension, viscosity and refractive index). Liquid crystal-difference between liquid crystal, solid and liquid.

Solid state

Defination of space lattice, unit cell crystal planes, Matter indices. Laws of crystallography-(i) law of constancy of interfacial angles (ii) law of rationality of indices (iii) law of symmetry. Symmetry elements in crystals. X-ray diffraction by crystal, Derivationof Bragg equation. Determination of crystal structure of NaCL, KCL and CsCL(Laue's method and powder methods).

Colloidal State

Defination of colloids, classification of colloids.

Solids in liquids (sols): properties-Kinetic, Optical and electrical, stability of colloids, protective action, Hardy-schulze law, gold number. Liquids in liquids(emulsions): type of emulsions, prearation.emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

Chemical Kinetics and Catalysis

Chemical Kinetics and its scope, rate of reaction, factors influencing the rate of a reaction-concentration, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reaction-zeo order, first order, second order, pseudo order, half life and mean life. Determinination of the order of reaction-differential method, metho integration, method of half life period and isolation method, concept of activation energy. Radioactive decay as a first order phenomenon. Catalysis, characteristics of catalysed reaction, classification of catalysis, miscellaneous examples.

Thermodynamics

Defination of thermodynamic terms, system, surrounding etc. Types of systems, intensive and extensive properties, state and path function and their differentials, intensive and extensive thermodynamic process, concept of heat and work.

First law of thermodynamics, statement, definition of internal energy and enthalpy. Heat capacity-heat capacities at constant volume and pressure and their relationship, Joule's law. Joule'sThomson co-efficient and inversion temperature, Calculation of w, q, dU & dH for the expension of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry-standard state, standard enthalpy of formation Hess's law of heat summation and its applications, heat of reaction at constant volume. Enthalpy of neutralization, bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchoff's equation.

MATHS PAPER -1

(A) MATRICES

Symmetric, skew symmetric, Hermitian and skew Hermitian matrices, elementary operations on matrices, inverse of a matrix, linear independence of row and column matrices, row rank, column rank and rank of a matrix, equivalence of column and ranks, eigen values, eigen vectors and the characterstic equation of a matrix, caley halmilton theorem and its use in finding inverse of a matrix, application of matrix to a system of linear(both homogeneous and non- homogeneous) equations, theorems on consistency of a system of linear equations.

(B) TRIGNOMETRY:

Elementary knowledge of a complex variable including complex in equalities, exponential and logarithmic , circular and hyperbolic function together with their inverses, gregory's series, summation of a trigonometry series, trigonometric expansion of sine and cosine as finite products(without rigorous proof)

(C) VECTOR ANALYSIS:

Vector Algebra- trible products, reciprocal vectors, products of four vectors. Vector differentiation- ordinary derivatives of vectors, applications to differential geometery curves in spaces, derivatives of the fundamental vectors t, n and b and relations connecting them, angle between two surfaces, differential operator del, definitions of del, gradient, divergence, curl, vector identities.

Vector Integration- line, surface and volume integrals, simple application of Gauss' divergence theorem and Stokes' theorem (without proof)

MATHS PAPER -2 CALCULUS

(A) Differential Calculus

Rolle's theorem, mean value theorem, expansion of functions, indeterminate forms, asymptotes, curvature, envelopes and evolutes, double points, curve tracing, partial differential and change of independent variables (two variables), Jacobians (simple applications-function case), Maxima and minima up to two independent Variables.

(B) Integral Calculus

Definite integrals, integral as limit of sum, fundamental theorem of integral calculus (statement only), beta and gamma integrals, change of order of integration in double integrals, Dirichlet's theorem and its liouville's extension, area (quadrature), rectification (length of curves), Volume and surface, differentiation and integration under the integral sign.

MATHS PAPER – III GEOMETRY OF TWO AND THREE DIMENSIONS

(A) Two Dimensions

General equation of second degree and tracing of conics, polar equation of a conic, equation of a chord, tangent, normal and polar to a conic.

(B) Three Dimensions

System of coordinates in three dimensions, change of origin, projections, dcs and drs , change of axes, plane straight line, intersection of three planes, volume of tetrahedron, sphere, cylinder, cone. Central conicoids with all the properties there in, paraboloids, General equation of second degree in the dimensions. Coordinate system & coordinate transformations, orthogonal Cartesian, spherical polar & cylindrical polar.

SPECIALIZATION PAPERS

DIGITAL ELECTRONICS

Introduction , number system, binary,octal, hexadecimal, character codes(BCD), ASCII, EBCDIC and their conversion, logic gates(And,or,Not), universal gate, Boolean alzebra, K- map Simplication, half adder, full adder, substractor, decoder, encoders, multiplexer, dimultiplexer, carry look ahead adder, combination logic design, flip flop, registers, counters(synchronous and asynchronous) ,ALU, Micro operation, ALU chip, faster algorithms and implementation(multiplication and division)

INDUSTRIAL ELECTRONICS

Unit – I Control Systems

Introduction to Automatic control system, open loop control systems, closed loop control systems, solved examples on Automatic Control Systems.

Unit – II Magnetic Control System

Introduction, Contactor control circuit components, Basic principles of Design of control circuit, schematic and writing diagrams for motor control circuits, protections of motors.

Unit – III Semiconductor Physics

Introduction, Semiconductor material, Bond structure, Charge carriers, Intrinsic and Extrinsic semiconductors, Semiconductor devices, Mobility.

Unit – IV Thyristors and their Applications

Introduction, Applications, Symbolic representations, Specifications Thyristors ratings, Thyristors construction, Principle of operation of an SCR, Two- transistor Analog of SCR, comparison between Thyristors and Gas Tubes, comparison between Thyristors and Transistors, methods of triggering a thyristor , commutation of a thyristor, Thyristor Configurations, DIAC, TRIAC, Unijunction Transistor (UJT).

Unit – V Inverters, Choppers and Cycloconverters

Unit – VI Solid State control of d.c. and a.c. Motors

Unit –VII Thyristor Control Circuit

Unit – VIII Electronic Control of Heating and Welding

Unit – IX Photoelectric Devices

Light Dependent Resistor (LDR), Light Emitting Diode (LED), Photodiodes, Phototransistors, Photoelectric Emission.

Unit – X Transducers

Introduction, Classification of Transducers, Transducers in Instrumentation and Control Systems, Selection of Transducer, Strain Gauge as a Transducer, Variable resistance Transducer, Capacitive Transducer, Inductive Transducer, Potentiometric Resistance Type Transducer, Piezoelectric Transducers, Linear Variable differential Transformer Transducer, Thermistors, Thermocouples (Thermo electric Thermistors).

Unit – XI Amplifiers

Magnetic Amplifiers, Thyratron and Thyratron Amplifiers, Operational Amplifier.

Unit – XII Ultrasonic

Application of Ultrasonics, Generation of Ultrasonics, pulsed echo Ultrasonic Flaw Detection.

SYLLABUS of B.Sc (Electronics)-2nd Year

PHYSICS PAPER I THERMODYNAMICS AND HEAT

Unit – I Thermodynamics concept and Frist law of Thermodynamics

Macroscopic and microscopic system, internal and external energy states of a molecule, Equilibrium and thermodynamic variables of a system, temperature: Zeroth law of thermodynamics, equation of stare, work Indicator diagram, internal energy and first of the thermodynamics, the two sp. Heat substance, joule's law of perfect gas , Cp, Cy, quasi static processes , Adiabatic process (change of temperature and work done with examples), perfect gas model and quantitative checks on it, kinetic theory of gases, vander waals equations, joules Expansion of real gas.

Unit – II Second law of Thermodynamics and Entropy

Insufficiency of first law of thermodynamics, heat Engine and its efficiency, Reversible and irreversible process, Carnot's cycle, carnot's theorem, Second Law of thermodynamics, clausius theorem and entropy, Mathematical formulation of II law of thermodynamics, Entropy of an ideal gas, T-S diagram, principle of increase of entropy and its application, Evaluation of entropy changes in in simple cases, thermodynamics scale of temperature and its identity to perfect gas scale of temperature. Second law in terms of entropy. Third law of thermodynamics as unattainability of absolute zero :Nerust heat theorem.

Unit –III Thermodynamics relations and production of low temperature

Single valued functions of state, intensive and extensive parameter, Maxwell's thermodynamics relationships, thermodynamics potentials, Maxwell's equation from thermodynamics potentials, the clasusius –clapeyron latent heat and sp.heat equation, triple point, Applications of Maxwells thermo dynamical relations.

Introduction to cryogenics and refrigeration, cooling by evaporation :Vapour compression refrigerator, cascade or series refrigeration, cooling by adiabatic expansion: air compression machine,coolin by J.T throttling process, Hampson's and Linde's regeneration cooling machine, liquification of air .

Unit – IV Radiation

Radiation,blackbody, some definitions, thermodynamics of radiation inside a hollow enclosure Kirchhoff's law, Stefan-Boltzmann law from thermodynamics. Radiation from non-black bodies Wein'sdisplacement law and its deduction from thermodynamics. Rayleigh jean's law- the containing mode and average energy of plank's oscillators, plank's formula for black body spectrum. Derivation of stolen Boltzmann law, Wein's law, Rayleigh jeans law from plank's formula. Radiation as a photon gas.

Unit – V Specific Heat

Specific heat of simple solids- Dulong and petit's law, departure of the at low temp., Einstein's theory of specific heat and its limitations.

Lattice vibrations, phonons- Debye's theory of specific heat of solids, specific heat of diatomic gases and its variation with temperature.

PHYSICS PAPER – II: OPTICS

UNIT – I: Geometrical Optics:

Fermat's principle: Principle of extremum path and its application to deduce laws of reflection and refraction, Aplantic points of sphere, Gauss's general theory of image formation: coaxial symmetrical systems, cardinal points of an optical system, general relationshio, thick lens and lense combinations, Lagrange equation of magnification, telescopic combinations, telephoto lenses.

UNIT – II: Optical Instruments:

Entrance and exit pupils, need for a multiple lens eyepiece, Ramsden's, Hygens's and Gaussian eyepieces, astronomical refracting telescope, Spectrometer, Aberrations in images: chromatic aberrations, chromatic combination of lenses in contact and separated lenses, monochromatic aberrations and their reduction: a spherical mirrors and Schmidt corrector plates, aplantic points, oil immersion objectives meniscus lens.

UNIT – III: Physical Optics:

Interference of light: the principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations, leteral shift of fringes, biprism, Rayleigh refractometer, Interference with multiple reflection, thin films application for precision measurements, Haidinger fringes: fringes of equal inclination, Michelson interferometer and its application for precision measurement of wavelength difference and width of apectral lines, Twyman Green interferometer and its uses, Internsity distribution in multiple beam, Tolanski fringes, Fabry Perot interferometer and etalon.

UNIT – IV: Diffraction:

Fresnel's diffraction: Fresnel half period zones, straight edge, circular aperture of disc, rectilinear propagation, zone plates.

Fraunhofer diffraction: diffraction of a single slit, phasor diagram and integral calculus methods, the intensity distribution, diffraction of a circular aperture, Resolution of images, Rayleigh criterion, resolving power of telescopes and microscopic systems, outline of phase contrast microscopy, Difraction of 2-slits and N-slits intensity distribution, phas diffraction, grating, reflection grating and blazed gratings, concave grating and different mountings, reslving power of a grating and comparision with resolving power prism and of a Fabry Perot etalon.

UNIT – V: Polarization of light:

Concept of plane polarized light, plane, circularly and elliptically polarized light, Malus law, brester's law, Double refraction: refraction and uniaxial crystal, its electromagnetic theory, phase retardation plates, double images prisms, application of birefringence, dichroism, production and analysis of polariaed light, Polaroid and wire grid polarizer, optical rotation: Rotation of plane of polariazation, origin of optical rotation in liquids and in crystals, rotation, polarimeter, half shade and biqartz polarimeter.

PHYSICS PAPER-III SOLID STATE PHYSICS AND STATISTICAL MECHANICS

SOLID STATE PHYSICS

Unit I – Crystals

Simple crystal and polycrystalline forms, lattice, basis and crystal structure, translational symmetry and basis vector. Unit cell (primitive and non-primitive), two dimensional point groups and Bravis lattices, Miller indices, sc, bcc, and sodium chloride structures, closed packed structures (fcc and hcp) reciprocal lattice, X-ray diffraction, Bragg's law, Laue and powder methods of X-ray diffraction, Introductory electron and neutron diffraction.

Unit II – Lattice Vibrations

Vibration of an elastic homogeneous line and monoatomic lattice, Concept of lattice phonons.

Free electron theory of metals: outline and limitation of Lorentz Drude theory, Somerfield theory of free electrons, Specific heat and Para magnetism of free electron. Results of Kronig Penny model, Distinction between conductors, semiconductor and insulators, Intrinsic and Extrinsic semiconductors.

STATISTICAL MECHANICS

Unit III – The Statistical Basis of Thermodynamics

Probability and thermodynamic probability, postulate if equal a priori probability, probability distribution and its narrowing with increase in number of particles, Ensemble and Average properties, Equilibrium and fluctuations , Constraints, Distribution of particles with given total energy into a discrete set of energy states.

Unit IV – Some Universal Laws

The mu-space representation, division of mu-space into energy sheets and into phase cells of arbitrary size, application of one dimensional Harmonic oscillator and free particles, Equilibrium between two systems in thermal contact the β parameter, Entropy and probability Boltzmann entropy relation , Statistical interpretation of second law of thermodynamics, Boltzmann canonical law and its applications, rigorous form of equiparatition of energy, some numerical exercises on canonical distribution.

CHEMISTRY PAPER-1 INORGANIC CHEMISTRY

1:-Chemistry of Elements of First Transition Series

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

2:-Chemistry of Elements of Second and Third Transition Series

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

3:-Oxidation and Reduction

Standard electrode potential, Use of red ox potential, data, reaction feasibility and computation of equivalent weights.

4:-Coordination Compounds

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

5:-chemistry of lanthanides

Electronic structure , oxidation states , ionic radii, lanthanide contraction, complex formation, methods of separation of lanthanides-fractional crystallization, fractional precipitation, change in oxidation state, ion exchange, and solvent extraction.

6:-Chemistry of Actinides

General features of actinides-electronic configuration, atomic and ionic radii, ionization potential, oxidation state and complex formation.

7:-Acid and Base

Athenius, Bronsted-Lowery, Lux-Flood solvent system and Lewis concepts of acids and bases.

8:-Non-aqueous Solvents

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

CHEMISTRY PAPER-II ORGANIC CHEMISTRY

1:-Electromagnetic Spectrum : Absopption Spectra

Ultraviolet (UV) absorption spectroscopy - molecular laws (Beer-Lambert law) , molar absorpitivity, presentation and analysis of UV of spectra, types of electronic transitions, effect of conjugation, Concept of chromophore and auxochrome. Bathochromic , hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Infrared(IR) absorption spectroscopy-molecular viberations, Hookes' law, selection rules, finger print region,characteristics absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

2:-ALCOHOL

Classification and nomenclature.

Monohydric alcohol-nomenclature , methods of formation by reduction aldehydes , ketones, carboxylic acids and esters.

Hydrogen Bonding Acidic nature. Reactions of alcohols.

Dihydric alcohols- nomenclature, methods of formation, chemical reaction of vicinal glycols, oxidative cleavage [Pb(OA)4 and HIO4) and pinacol-pinacolone rearrangement.

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

3:-PHENOLS

Nomenclature, structure and bonding. Prepration of phenols, physical properties and acidic character. Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion. Reaction of phenols-electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Clainsen rearrangement, Gattermann synthesis,Hauben-Hoesch reaction, Leaderer-Manasse reaction and Reimer-tiemann reaction.

4:-Ethers and Epoxides

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

5:-Aldehydes and Ketones

Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acids chlorides, synthesis of aldehyde and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids, Physical properties.Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevengel condensations. Condensations with ammonia and its derivatives. Witting reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyers-Villager oxidation of ketones, Cannizaro reaction, MPV, Clemmensen, Wolff-Kishner, LIAH4 and NaBH4 reductions.Halogenations of enolizable ketones. An introduction to α- β unsaturated aldehydes & Ketones.

6:-Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acids strength. Prepration of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zorlinsky reaction.Synthesis of acid chlorides, esters, and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

Methods of formation and chemical reaction of halo acids. Hydroxy acidsmalic, tartaric and citric acids.

Dicarboxylation acids-methods of formation and effect of heat and dehydrating agents.

7:-Carboxylic Acid Derivatives

Structure and nomenclature of acids chlorides, esters, amides (Urea) and acid anhydrides. Lative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

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

8:-Organic Compounds of Nitrogen

Prepration of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitutions in nitroarenes and their reductions in acidic, neutral and alkaline media, picric acid. Halonitroarenes-reactivity. Structure and nomenclature of amines, physical properties. Seperation of a mixture of primary, secondary, and tertiary amines. Structural features affecting basicity of amines. Amine salts as phasetransfer catalysts. Prepration of alkyl and aryl amines, (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, axo coupling.

9:-Organic Synthesis via enolates

Acidity of hydrogen, alkylation of diethylmalonate and ethyacetoacetate. Synthesis of ethyl acetoacetate, the Claisen condensation, Keto-enol tautomerism of ethylacetoacetatae.

CHEMISTRY PAPER -3RD PHYSICAL CHEMISTRY

1. **Thermodynamics-II**

   Second law of thermodynamics, need for the law, different statement of the law. Carnot-cycle and its effiencicency, Carnot theorem. Thermodynamic scale of temperature.

   Concept of entropy : entropy as a state function, entropy as a function of V&T, entropy of a function of P&T, entropy change in physical change, Clausius intequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A&G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

2. **Chemical Equilibrium**

   Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chaterlier's principle. Effect of temptature on equilibrium constant. Reaction isotherm and reaction. Isochore-Clapeyron equation Clausius-Clapeyron equation, applications.

3. **Phase Equilibrium**

   Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, CO2 and S.

   Phase equilibria of two component system-solid-liquid equlibria, simple eutectic-Bi—Cd, Pb-Ag system, desilverisation of lead.

   Solid solutions-compound formation with congruent melting point.(Mg-Zn) and incongruent melting point (NaCl- H2O, FeCl3- H2O) and CuSO4-H2O system. Freezing mixtures, acetone-dry ice.

   Liquid-liquid mixtures-ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes HCl-H2O and ethanol-water system.

   Partially miscible liquids-phenol-water, trimethylamine-water, nicotine-water sysem, Lawer upper consolute temperature. Effect of impurity on temptaure. Immiscible liquids, steam distillation.

   Nernst distribution law-thermodynamic derivation, applications.

4. **Electrchemistry**

   Electrical transport-conduction in metals in electrolyte solutions, specific conductance, measurement of equivalent conductance, variation of equivalent and specific conductance

with dilution. Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolyte, Ostwald's dilution and its uses and limitations.

Debye-Huckel theory, equation for strong electrolytes (elementary treatment only). Migration of ions, Transport number, definition and determination by Hittorf method and moving boundary methods, Kohlroush's law.

Application of conductivity measurement-detemination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductrometric titrations.

5. **Electrochemistry-II**

Types of reversible electrodes-gas-metal ion, metalion, metal-insoluble salt-anion and fedox electrodes. Electrode reaction, Nernst equation, derivation of cell E.M.F and single electrode potential, standard hydrogen electrode-reference electrodes, standard electrode potential, sign cinventions, electrochemical series and its significance. Electrolytric and Galvanic cell-revesible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurement. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (G, H and K) polarization decomposition potentials, over potential and hydrogen over valtage. Defination of pH and PKa, determination of pH using hydrogen, quinhydrone, and glass electrodes by potentionation of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods. Buffers-mechanism of buffer action, Henderson equation, Hyrolysis of salts.

6. **Surface chemistry**

Types of fadsorption, Freundlich's and Langmuir's adsorption isotherm and their applications, charge on the colloidal particle, size of the colloidal particle, Perrin,s method of determination of the Avogadro's number.

MATHS PAPER-1 ABSTRACT ALGEBRA
(GROUP THEROY AND RING THEORY)

(A) Theory of Equation

Relation between the roots and coefficients of general polynomial equation in one variable. Tansformation of equations. Descrates rule of signs, Solution of cubic equation (Cardon's method). Biquadratic equations.

(B) Group Theory

Binary operations on a set. Definitions, examples and simple properties of group. Finite groups and group tables. Order of a group and order of an element of a group. Abelian and cyclic groups. Groups of permutations: permutation, multiplication. Symmetric group. Cycle and cyclic notations. Even and odd permutations. Alternating groups. Subgroups-definitions and Illustration. Necessary and sufficient conditions on non-empty subsets for being subgroups. Cosets-Definition, Algebra and application to Lagrange's theorem, corollaries of Lagrange's theorem. Isomorphism-Definition, simple theorems and problems regarding isomorphic groups, Cayley's theorems. Normal subgroups-Definitions condition on a subgroup for being a normal subgroup, factor group. Homomorphism-definition, simple properties, kernel of homomorphism.

(C)Ring Theory

Definitions, examples and simple results relating ti rings. Special rings-integral domain, skew field and field, characteristics of an integral domain. Ring isomorphism, Ring homomorphism, Subring and Ideals

MATHS PAPER-1

DIFFERENTIAL EQUATIONS, CONVERGENCE AND DIVERGENCE

(A) Differential Equations

Differential equations of first order and first degree, Clairaut's form, singular solutions, trajectories, Linear equations with constant coefficients and of the form, dx/P= dy/Q= dz/R , where P ,Q , R are function of x ,y ,z Homogenous linear equations, Exact differential equations, Linear differential equations of second order with variable coefficients, Total differential equations, Solution in Series , Partial differential equations of the first order, Charpit 's method , Linear partial differential equations with constant coefficients.

(B) Convergence of Sequence and Series

Sequences, Bounded sequences, Convergent sequences, Monotone sequences, Sub Sequences, Convergences of infinite series, various tests for convergence of infinite series.

MATHS PAPER-3

STATIC AND DYNAMICS

(A) Statics

Centre of gravity in two and three dimensions, Strings in two dimensions (Common catenary of catenary of uniforms strength only). Virtual works, Forces in three dimensions, central axis.

(B) Dynamics

Kinematics, Rectilinear motions, Motion in resisting medium, central orbits (Excluding Kepler's Laws), Constrained motion (Circular and cycloidal motions only), Moments and products of inertia (simple cases, theorem of parallel axis, momental ellipsoid, principal axes).

SPECIALIZATION PAPERS

EMI

UNIT 1: Measurement and error: definition, accuracy, significant figure, types of errors, statistical analysis, probability of error, limiting errors, related problems.

UNIT 2: Standards of measurements, classification of standards, standards of mass, length and volume. Time and frequency standards, electrical standard.

UNIT 3: Electronic instruments for measuring basic parameters, Introduction amplified DC meter, A.C. voltmeter using rectifiers, True RMS-responding voltmeters, electronics multimeters, digital voltmeters.

UNIT 4: Analog and digital data acquisition system, instrumentation system, interfacing transducers to electronic control and measuring systems.

SSDC

Unit-1

Introduction to two terminal devices, Schottkey barrier (hot carrier) diodes, Varactor diodes, Power diodes, Photo diodes, Photo conducting cells, thermister.

Unit-2

Introduction to power devices, pn-np diodes, base structure, Forward blocking states, Conducting state.

Unit-3 Introduction to negative conductance microwave devices, Tunnel diodes operation and circuit operation, IMPATT diode, Gunn diode.

Unit-4

Introduction and evolution of integrated circuit: background, advantages, types of integrated circuits, monolithic and hybrid circuits