PHYSICAL SCIENCE

PART A

Module I : Renaissance and freedom movement

Module II: General Knowledge and current affairs

Module III: Methodology of teaching the subject

- History/conceptual development. Need and Significance, Meaning Nature and Scope of the Subject.
- Correlation with other subjects and life situations.
- Aims, Objectives, and Values of Teaching - Taxonomy of Educational Objectives - Old and revised
- Pedagogic analysis- Need, Significance and Principles.
- Planning of instruction at Secondary level- Need and importance. Psychological bases of Teaching the subject - Implications of Piaget, Bruner, Gagne, Vygotsky, Ausubel and Gardener - Individual difference, Motivation, Maxims of teaching.
- Methods and Strategies of teaching the subject- Models of Teaching, Techniques of individualising instruction.
- Curriculum - Definition, Principles, Modern trends and organizational approaches, Curriculum reforms - NCF/KCF.
- Instructional resources- Laboratory, Library, Club, Museum- Visual and Audio-Visual aids - Community based resources - e-resources - Text book, Work book and Hand book.
- Assessment; Evaluation- Concepts, Purpose, Types, Principles, Modern techniques - CCE and Grading- Tools and techniques - Qualities of a good test - Types of test items- Evaluation of projects, Seminars and Assignments - Achievement test, Diagnostic test – Construction, Characteristics, interpretation and remediation.
- Teacher - Qualities and Competencies - different roles - Personal Qualities - Essential teaching skills - Microteaching - Action research.

PART B

Module I

Particle dynamics-Newton's laws of motion, rotational dynamics, conservation laws- Linear momentum, angular momentum, energy. Simple harmonic motion, damped and forced oscillations, wave motion-progressive waves, super position of waves, Doppler effect.
Frames of reference, special theory of relativity
Elasticity-Young's modulus, rigidity modulus, bulk modulus, surface tension, viscosity.

Module II

Electrostatics, transient current, current electricity, electromagnetic induction, alternating current, magnetic properties of materials.

Semiconductor physics- diodes, transistors, amplifiers, oscillators, logic gates.

Module III

Reflection, refraction, dispersion, interference, diffraction, scattering, polarization, fibre optics, lasers, basic idea of spectroscopy.

Heat and thermodynamics-conduction, convection, radiation,laws of thermodynamics, Carnot engine, entropy.

Statistical distribution-ensemble, phase space, Maxwell-Boltzmann statistics.

Module IV

Bohr atom model, vector atom model, hydrogen spectra, nuclear structure and properties, radio activity, nuclear fission and fusion, elementary particles.

Crystal structure, crystal symmetry, miller indices, brevais lattice, Bragg's law, packing fraction, super conductivity.

Wave nature of matter, uncertainty principle, postulates of wave mechanics, Schrodinger equation.

Module V

Eigen functions and Eigen values -Postulates of quantum mechanics Time Schrödinger wave equation - Application to particle in a one dimensional box – Normalization of wave functions - Application of Schrödinger wave equation to hydrogen atom – Conversion of cartesian coordinates to polar coordinates - Radial and angular functions (mention only) – Orbitals and concept of Quantum numbers

Energy levels in molecules - Born-Oppenheimer approximation. *Rotational, vibrational, Raman, Electronic and NMR spectroscopy:* Basic Principles and applications. Elements of symmetry of molecules

Amorphous and crystalline solids , Defects in crystals - Stoichiometric and non stoichiometric defects . Ideal and non ideal solutions -Henry's law , Raoult's law - Dilute solutions - Colligative properties - Abnormal molecular mass – Van't Hoff factor.

Solubility product and common ion effect, precipitation of cations , Principles of volumetric analysis, Theories of indicators.

Principles and applications of Column chromatography, Paper chromatography, Thin layer chromatography, Ion exchange chromatography, - Rf values.

Structure and applications of silicones, silicates and zeolites. Cement , Glass , Inorganic fertilizers , Rocket propellants (Brief study)

Types of pollution: Air and water. Pollutants , Control of air and water pollution

Module VI

Atom Models– Planck's quantum Theory - Photoelectric effect -de Broglie's relation – Dual nature of matter and radiation, Heisenberg's uncertainty principle. Atomic orbitals and Quantum numbers - Pauling's Exclusion principle - Hund's rule of maximum multiplicity - Aufbau's principle – Electronic configuration of atoms.

Ionic bond – Properties - Born-Lande equation (derivation not expected) – Born-Haber cycle – Fajan's rules and its applications. Covalent bond - Valence bond theory–VSEPR Theory - Concept of Hybridisation –-Types: sp, sp^2, sp^3, dsp^2, sp^3d, d^2sp^3,sp^3d^2 - Explanation with simple examples .Molecular Orbital Theory – LCAO - Bonding and anti bonding molecular orbitals - Bond order. Theories of Metallic bonding: Free electron theory, valence bond

theory and band theory (Basics concepts only).Hydrogen bond – Intra and inter molecular hydrogen bond.
Periodic laws, – Periodic properties – Electronegativity scales (Pauling and Mullikan scales) – Effective nuclear charge – Slater rule – Diagonal relationship
Representative and Transition Elements – General Characteristics, preparation and properties of simple compounds. Lanthanides and actinides
Metals: Occurrence, Concentration of ores, Refining of metals, Extractive metallurgy of Al, Fe, Ni, Cu and Ti – Classification of steel, hardening of steel.
Isomerism in coordination compounds - Werner's theory -EAN rule - Valence bond theory - Crystal filed theory - Splitting of d-orbitals in octahedral, tetrahedral and square planar complexes –Applications
Organometallic Compounds: Definition, Classification and Applications
Radioactivity –Natural and artificial, Nuclear stability – N/P ratio –Nuclear forces –Half life period – Gieger Nuttal rule –Disintegration series – Transmutation , Nuclear fission and Nuclear fusion –Application of radioactive isotopes

Module VII
Postulates of kinetic theory of gases - Collision number.
First law of thermodynamics – Joule-Thomson effect - Liquefaction of gases – Inversion temperature. Second law of thermodynamics - Concept of entropy - Entropy as criteria of spontaneity. Free energy functions - Hess's law, Bond energies. Third law of thermodynamics.
Law of mass action - Law of chemical equilibrium - Equilibrium constant in terms of concentration, partial pressure and mole fractions Van't Hoff's equation - Homogeneous and heterogeneous equilibria - Le Chatelier's Principle and its applications.
Rate of a reaction - Factors influencing the rate of a reaction - Rate law - Order and molecularity - Rate constants for first, second, third and zero order reactions - half life period for first order reaction- Arrhenius equation - Collision theory - Transition state theory - Homogeneous and heterogenous catalysis - Enzyme catalysis
Photosynthesis - Simple Photochemical reactions – Fluorescence – Phosphorescence
Chemisorption and physisorption - Factors affecting adsorption - Adsorption isotherms Classification , Preparation, purification and properties of colloids, Protective colloids - Gold number - Applications of colloids.
Phase Equilibria: Components and degrees of freedom - One component and two component systems (Simple cases only)
Faraday's laws, Kohlrausch's law - Arrhenius theory, Ostwald's dilution law – Debye - Huckel - Onsager's equations for strong electrolytes, Galvanic cells, electrochemical series - Nernst equation

Module VIII
Uniqueness of Carbon , Classification of organic compounds - Hybridization of carbon in organic compounds. Structural and Stereoisomerism, Baeyer strain theory, Conformation and configuration - Specific rotation – Chirality, Enantiomers, Diastereomers– Racemic mixture - Resolution methods
Inductive effect, Mesomeric effect, Hyperconjugation and Electromeric effect - Steric effect. *organic reactions:* Substitution, Addition, Elimination and Rearrangement . Mechanisms of SN1, SN2, E1 & E2
Nomenclature of organic compounds– Preparation and properties of alkanes, alkenes, alkynes, alkyl halides, alcohols, aldehydes and ketones, carboxylic acids & their derivatives.

Aromaticity, Huckel's rule - Structure and stability of benzene, Electrophilic substitution reactions in benzene with mechanisms

Grignard reagent-Preparation and synthetic applications

Classification of polymers, preparation and applications of important polymers, biodegradable polymers

Biomolecules: Carbohydrates, proteins, nucleic acids, vitamins (Classifications with examples, applications/functions)