ANNEXURE –II: SYLLABUS

(as prescribed by Goa Board of Secondary & Higher Secondary Education at **STD. XII)**

PHYSICS

UNIT I: ELECTROSTATICS

Electric charges and their conservation. Coulomb's law – force between two point charges, forces between multiple charges; superposition principle and continuous charge distribution.

Electric field, electric field due to a point charge, electric field lines; electric dipole, electric field due to a dipole; torque on a dipole in a uniform electric field. Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet .

Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipoles in an electrostatic field.

Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor, Van de Graaff generator.

UNIT II: CURRENT ELECTRICITY

Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current; Ohm's law, electrical resistance, *V-I* characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity.

Temperature dependence of resistance.

Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel. Kirchhoff 's laws and simple applications. Wheatstone bridge, metre bridge.

Potentiometer – principle and applications to measure potential difference, and for comparing emf of two cells; measurement of internal resistance of a cell.

UNIT III: MAGNETIC EFFECTS OF CURRENT AND MAGNETISM

Concept of magnetic field, Oersted's experiment. Biot - Savart law and its application to current

carrying circular loop. Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids. Force on a moving charge in uniform magnetic and electric fields. Cyclotron.

Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors – definition of ampere. Torque experienced by a current loop in a magnetic field; moving coil galvanometer – its current sensitivity and conversion to ammeter and voltmeter.

Current loop as a magnetic dipole and its magnetic dipole moment. Magnetic dipole moment of a revolving electron. Bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements.

UNIT IV: ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENTS

Electromagnetic induction; Faraday's law, induced emf and current; Lenz's Law, Eddy currents. Self and mutual inductance.

Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; AC generator and transformer.

UNIT V: ELECTROMAGNETIC WAVES

Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves.

Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses.

UNIT VI: OPTICS

Mirror formula. Refraction of light, total internal reflection and its applications, optical fibres, refraction at spherical surfaces, lenses, thin lens formula, lens-maker's formula.

Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror.

Refraction and dispersion of light through a prism.

Optical instruments: Human eye, image formation and accommodation, correction of eye defects (myopia and hypermetropia) using lenses.
Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers.
Wave optics: Wavefront and Huygens' principle, reflection and refraction of plane wave at a plane surface using wavefronts.
Proof of laws of reflection and refraction using Huygens' principle.

Interference, Young's double hole experiment and expression for fringe width, coherent sources and sustained interference of light.
Diffraction due to a single slit, width of central maximum.

UNIT VII: DUAL NATURE OF MATTER AND RADIATION

Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation – particle nature of light.

Matter waves – wave nature of particles, de Broglie relation.

UNIT VIII: ATOMS AND NUCLEI

Alpha - particle scattering experiment; Rutherford's model of atom; Bohr model, energy levels,

hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars; isotones.

Mass-energy relation, mass defect; nuclear fission and fusion.

UNIT IX: ELECTRONIC DEVICES

Energy bands in solids (qualitative ideas only), conductors, insulators and semiconductors;

semiconductor diode – *I-V* characteristics in forward and reverse bias, diode as a rectifier; *I-V* characteristics of LED, photodiode, solar cell. Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

Books: Published by Goa Board of Secondary and Higher Secondary Education.

1. Physics Part I Textbook for class XII
2. Physics Part II Textbook for class XII

CHEMISTRY

UNIT I: SOLID STATE

Classification of solids based on different binding forces :molecular, ionic covalent and metallic solids, amorphous and crystalline solids(elementary idea),unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids ,number of atoms per unit cell in a cubic unit cell, point defects.

UNIT II : SOLUTIONS

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties – relative lowering of vapour pressure, Raoult's law , elevation of B.P., depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties.

UNIT III: ELECTROCHEMISTRY

Redox reactions; conductance in electrolytic solutions, specific and molar conductivity variations of conductivity with concentration, Kohlrausch's Law, electrolysis, EMF of a cell, standard electrode potential,

Nernst equation and its application to chemical cells. Relation between Gibbs energy change and EMF of a cell.

UNIT IV: CHEMICAL KINETICS

Rate of a reaction (average and instantaneous), factors affecting rates of reaction: concentration, temperature, catalyst; order and molecularity of a reaction; rate law and specific rate constant, integrated rate equations and half life (only for zero and first order reactions).

UNIT V: SURFACE CHEMISTRY

Adsorption – physisorption and chemisorption; factors affecting adsorption of gases on solids; colloidal state: distinction between true solutions, colloids and suspensions; lyophillic, lyophobic multimolecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation.

UNIT VII: *P*-BLOCK ELEMENTS

*Group 15 elements***:** General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; nitrogen – preparation, properties and uses; compounds of nitrogen: preparation and properties of ammonia and nitric acid,

Group 16 elements **:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; dioxygen: preparation, properties and uses; classification of oxides; ozone. Sulphur – allotropic forms; compounds of sulphur: preparation, properties and uses of sulphur dioxide; properties and uses, oxoacids of sulphur (structures only).

Group 17 elements **:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens: preparation, properties and uses of chlorine and hydrochloric acid, interhalogen compounds, oxoacids of halogens (structures only).

*Group 18 elements***:** General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

UNIT VIII: *d* AND *f* BLOCK ELEMENTS

General introduction ,electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals – metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation.

Lanthanoids – electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences.

UNIT IX: COORDINATION COMPOUNDS

Coordination compounds : Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, bonding, Werner's theory VBT,CFT;

UNIT X: HALOALKANES AND HALOARENES

Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions. Optical rotation.

Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only).

UNIT XI: ALCOHOLS, PHENOLS AND ETHERS

A*lcohols***:** Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration.

Phenols **:** Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophillic substitution reactions, uses of phenols.

Ethers **:** Nomenclature, methods of preparation, physical and chemical properties, uses.

UNIT XII: ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

*Aldehydes and Ketones***:** Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, and mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes; uses.

*Carboxylic Acids***:** Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

UNIT XIII: ORGANIC COMPOUNDS CONTAINING NITROGEN

*Amines***:** Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines.

Cyanides and Isocyanides – will be mentioned at relevant places in context.

UNIT XIV: BIOMOLECULES

Carbohydrates – Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D-L configuration.

Proteins **-** Elementary idea of α - amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins;

*Nucleic Acids***:** DNA and RNA

Books: Published by Goa Board of Secondary and Higher Secondary Education.

1. Chemistry Part I Textbook for class XII
2. Chemistry Part II Textbook for class XII

MATHEMATICS

UNIT I: RELATIONS AND FUNCTIONS

1. **Relations and Functions** Types of relations: Reflexive, symmetric, transitive and equivalence relations. One to one and onto functions,
2. **Inverse Trigonometric Functions** Definition, range, domain, principal value branches.
3. **UNIT II: ALGEBRA**

1. **Matrices** Concept, notation, order, equality, types of matrices, zero matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices (restrict to square matrices of order 2).
2. **Determinants** Determinant of a square matrix (up to 3 × 3 matrices), minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

UNIT III: CALCULUS

1. **Continuity and Differentiability** Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Concepts of exponential, logarithmic functions.

   Derivatives of $\log_e x$ and e^x. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives.
2. **Applications of Derivatives** Applications of derivatives: Increasing/decreasing functions, tangents and normals, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

3. **Integrals** Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type –

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}}$$

$$\int \frac{(px+q)}{ax^2 + bx + c} dx, \int \frac{(px+q)}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2}\, dx, \int \sqrt{x^2 - a^2}\, dx$$

to be evaluated.

Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

4. **Applications of the Integrals** Applications in finding the area under simple curves, especially lines, arcs of circles/parabolas/ellipses (in standard form only),
5. **Differential Equations** Definition, order and degree, general and particular solutions of a differential equation. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type –

$\frac{dy}{dx} + Py = Q$ where P and Q are functions of x or constant

UNIT IV: VECTORS AND THREE-DIMENSIONAL GEOMETRY

1. **Vectors** Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and coplanar vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors.
2. **Three-dimensional Geometry** Direction cosines/ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Distance of a point from a plane.

UNIT V: LINEAR PROGRAMMING

Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

UNIT VI: PROBABILITY

Multiplication theorem on probability. Conditional probability, independent events, total probability, Baye's theorem. Random variable and its probability distribution. Repeated independent (Bernoulli) trials .

Books: Published by Goa Board of Secondary and Higher Secondary Education.

1. Mathematics Part I Textbook for class XII
2. Mathematics Part II Textbook for class XII