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Exam Pattern

Subject	No. of questions	Duration (minutes)
Physics	30	20
Chemistry	30	20
Mathematics	30	20
Aptitude & Logical reasoning	30	30
English	30	30
Total	150	150 mins (2 hrs 30 mins)

Physics Syllabus		
Unit	Unit Title	Syllabus
Unit – 1	Laws of Motion & Kinematics	<ol style="list-style-type: none"> 1. Force and Inertia, Newton’s First Law of motion; Momentum, Newton’s Second Law of motion; Impulse; Newton’s Third Law of motion. 2. Law of conservation of linear momentum and its applications, Equilibrium of concurrent forces. 3. Static and Kinetic friction, laws of friction, rolling friction. 4. Dynamics of uniform circular motion: Centripetal force and its applications. 5. Centre of the mass of a two-particle system, Centre of the mass of a rigid body; Basic concepts of rotational motion; the moment of a force, torque, angular momentum, conservation of angular momentum and its applications; the moment of inertia, the radius of gyration. 6. Values of moments of inertia for simple geometrical objects, parallel and perpendicular axes theorems and their applications. 7. Rigid body rotation, equations of rotational motion.
Unit – 2	Work, Energy & Power	<ol style="list-style-type: none"> 1. Work done by a constant force and a variable force; kinetic and potential energies, work-energy theorem, power. 2. The potential energy of a spring, conservation of mechanical energy, conservative and non-conservative forces; Elastic and inelastic collisions in one and two dimensions.
Unit – 3	Gravitation	<ol style="list-style-type: none"> 1. The universal law of gravitation. 2. Acceleration due to gravity and its variation with altitude and depth. 3. Kepler’s laws of planetary motion. 4. Gravitational potential energy; gravitational potential & Escape velocity. 5. Orbital velocity of a satellite. Geostationary satellites.
Unit – 4	Mechanical Properties of Solids & Fluids.	<ol style="list-style-type: none"> 1. Elastic behaviour, Stress-strain relationship, Hooke’s Law, Young’s modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal’s law and its applications. 2. Viscosity, Stokes’ law, terminal velocity, streamline and turbulent flow, Reynolds number. 3. Bernoulli’s principle and its applications. 4. Surface energy and surface tension, the angle of contact, application of surface tension – drops, bubbles and capillary rise. 5. Heat, temperature, thermal expansion; specific heat capacity, calorimetry; change of state, latent heat. Heat transfer- conduction, convection and radiation, Newton’s law of cooling.
Unit – 5	Oscillations & Waves	<ol style="list-style-type: none"> 1. Periodic motion: period, frequency, displacement as a function of time. Periodic functions. 2. Simple harmonic motion (S.H.M.) and its equation; phase; oscillations of a spring -restoring force and force constant; energy in S.H.M. – kinetic and potential energies; Simple

		<p>pendulum – derivation of expression for its time period; Free, forced and damped oscillations, resonance.</p> <ol style="list-style-type: none"> 3. Wave motion: Longitudinal and transverse waves, the speed of a wave. Displacement relation for a progressive wave. 4. The principle of superposition of waves, the reflection of waves, Standing waves in strings and organ pipes, fundamental mode and harmonics, Beats, Doppler effect in sound.
Unit – 6	Electrostatics	<ol style="list-style-type: none"> 1. Electric charges: Conservation of charge, Coulomb’s law- forces between two point charges, forces between multiple charges; superposition principle and continuous charge distribution. 2. 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. 3. Electric flux, Gauss’s law, and its applications to find field due to infinitely long uniformly charged straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. 4. Electric potential and its calculation for a point charge, electric dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of two point charges in an electrostatic field. 5. Conductors and insulators, Dielectrics and electric polarization, capacitor, the combination of capacitors in series and in parallel, the capacitance of a parallel plate capacitor with and without dielectric medium between the plates, Energy stored in a capacitor.
Unit – 7	Current Electricity	<ol style="list-style-type: none"> 1. Electric current, Drift velocity, Ohm’s law, Electrical resistance, Resistances of different materials, V-I characteristics of Ohmic and non-ohmic conductors, Electrical energy and power, Electrical resistivity, Colour code for resistors; Series and parallel combinations of resistors; Temperature dependence of resistance. 2. Electric Cell and its internal resistance, potential difference and emf of a cell, the combination of cells in series and in parallel. 3. Kirchhoff’s laws and their applications, Wheatstone bridge, Metre Bridge. 4. Potentiometer: principle and its applications.
Unit – 8	Magnetic Effects of Current & Magnetism	<ol style="list-style-type: none"> 1. Biot – Savart law and its application to current carrying circular loop. 2. Ampere’s law and its applications to infinitely long current carrying straight wire and solenoid. 3. Force on a moving charge in uniform magnetic and electric fields. Cyclotron. 4. Force on a current-carrying conductor in a uniform magnetic field. 5. The force between two parallel current-carrying conductors- definition of the ampere.

		<ol style="list-style-type: none"> 6. Torque experienced by a current loop in uniform magnetic field; Moving coil galvanometer, its current sensitivity, and conversion to ammeter and voltmeter. 7. Current loop as a magnetic dipole and its magnetic dipole moment. 8. Bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements. Para-, dia- and ferro- magnetic substances. 9. Magnetic susceptibility and permeability, Hysteresis, Electromagnets and permanent magnets.
Unit – 9	Electromagnetic Induction & Alternating Currents	<ol style="list-style-type: none"> 1. Electromagnetic induction: Faraday's law, induced emf and current; Lenz's Law, Eddy currents. 2. Self and mutual inductance. 3. Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance; LCR series circuit, resonance; Quality factor, power in AC circuits, wattless current. 4. AC generator and transformer.
Unit – 10	Ray Optics & Wave Optics	<ol style="list-style-type: none"> 1. Reflection and refraction of light at plane and spherical surfaces, mirror formula, Total internal reflection and its applications, Deviation and Dispersion of light by a prism, Lens Formula, Magnification, Power of a Lens, Combination of thin lenses in contact, Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers. 2. Wave optics: wavefront and Huygens' principle, Laws of reflection and refraction using Huygen's principle. 3. Interference, Young's double slit experiment and expression for fringe width, coherent sources and sustained interference of light. 4. Diffraction due to a single slit, width of central maximum. 5. Resolving power of microscopes and astronomical telescopes, Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroids.

Chemistry Syllabus		
Unit	Unit Title	Syllabus
Unit - 1	Structure of Atom	<ol style="list-style-type: none"> 1. Discovery of electron, proton and neutron; atomic number, isotopes and isobars. 2. Thompson's model and its limitations, Rutherford's model and its limitations, Bohr's model and its limitations. 3. Concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle. 4. Concept of orbitals, quantum numbers, shapes of s, p and d orbitals. 5. Rules for filling electrons in orbitals - Aufbau principle, Pauli exclusion principle and Hund's rule, electronic configuration of atoms, stability of half filled and completely filled orbitals.
Unit - 2	Classification of Elements and Periodicity in Properties	<ol style="list-style-type: none"> 1. Significance of classification, brief history of the development of periodic table. 2. Modern periodic law and the present form of periodic table. 3. Periodic trends in properties of elements –atomic radii, ionic radii, inert gas radii. 4. Ionization enthalpy, electron gain enthalpy, electronegativity, valence. 5. Nomenclature of elements with atomic number greater than 100.
Unit - 3	General Principles and Processes of Isolation of Elements	<ol style="list-style-type: none"> 1. Principles and methods of extraction – concentration, oxidation, reduction electrolytic method and refining. 2. Occurrence and principles of extraction of aluminium, copper, zinc and iron.
Unit - 4	Chemical Bonding and Molecular Structure	<ol style="list-style-type: none"> 1. Valence electrons, ionic bond, covalent bond, bond parameters. 2. Lewis structure, polar character of covalent bond, covalent character of ionic bond. 3. Valence bond theory, resonance, geometry of covalent molecules. 4. VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules. 5. Molecular orbital theory of homonuclear diatomic molecules (qualitative idea only). Hydrogen bond.
Unit - 5	Classification of Elements & Periodicity in Properties	<ol style="list-style-type: none"> 1. Modern periodic law and present form of the periodic table 2. s, p, d and f-block elements 3. Periodic trends in properties of elements atomic and ionic radii, ionization energy, valence, oxidation states and chemical reactivity
Unit - 6	Coordination Compounds	<ol style="list-style-type: none"> 1. Coordination compounds: Introduction, ligands. 2. Coordination number, colour, magnetic properties and shapes. 3. IUPAC nomenclature of mononuclear coordination compounds, bonding, 4. Werner's theory VBT, CFT; isomerism (structural and stereo) 5. Importance of coordination compounds (in qualitative analysis, extraction of metals and biological systems).

Unit - 7	States of Matter: Gases and Liquids	<ol style="list-style-type: none"> 1. Three states of matter, intermolecular interactions, types of bonding, melting and boiling points. 2. Role of gas laws in elucidating the concept of the molecule, Boyle's law, Charle's law, Gay Lussac's law, Avogadro's law. 3. Ideal behaviour, empirical derivation of gas equation. 4. Avogadro number, ideal gas equation. Kinetic energy and molecular speeds (elementary idea), deviation from ideal behavior. 5. Liquefaction of gases, critical temperature. 6. Liquid State – Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).
Unit - 8	Chemical Thermodynamics	<ol style="list-style-type: none"> 1. Concepts of System and types of systems, surroundings, work, heat, energy, extensive and intensive properties, state functions. 2. First law of thermodynamics -internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH, Hess's law of constant heat summation. 3. Enthalpy of bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution. 4. Second law of Thermodynamics (brief introduction) 5. Introduction of entropy as a state function, Gibb's energy change for spontaneous and non-spontaneous processes, criteria for equilibrium. 6. Third law of thermodynamics (brief introduction).
Unit - 9	Chemical Equilibrium	<ol style="list-style-type: none"> 1. Equilibrium in physical and chemical processes, dynamic nature of equilibrium. 2. Law of mass action, equilibrium constant, factors affecting equilibrium – Le Chatelier's principle. 3. Ionic equilibrium – ionization of acids and bases, strong and weak electrolytes. 4. Degree of ionization, ionization of polybasic acids, acid strength. 5. Concept of pH., Hydrolysis of salts (elementary idea). 6. Buffer solutions, Henderson equation, solubility product, common ion effect (with illustrative examples).
Unit - 10	Electrochemistry & Redox Reactions	<ol style="list-style-type: none"> 1. Redox reactions, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration. 2. Kohlrausch's Law, electrolysis and law of electrolysis (elementary idea). 3. Dry cell -electrolytic cells and Galvanic cells, lead accumulator, EMF of a cell, standard electrode potential. 4. Nernst equation and its application to chemical cells. 5. Relation between Gibbs energy change and emf of a cell, fuel cells, corrosion. 6. Concept of oxidation and reduction, redox reactions. 7. Oxidation number, balancing redox reactions, in terms of loss and gain of electrons and change in oxidation number, applications of redox reactions.

Unit - 11	Haloalkanes and Haloarenes	<ol style="list-style-type: none"> 1. Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties. 2. Mechanism of substitution reactions. Optical rotation. 3. Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogen for monosubstituted compounds only). 4. Uses and environmental effects of – dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.
Unit - 12	Alcohols, Phenols and Ethers	<ol style="list-style-type: none"> 1. Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only); identification of primary, secondary and tertiary alcohols; mechanism of dehydration, uses, with special reference to methanol and ethanol. 2. Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols. 3. Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.
Unit - 13	Aldehydes, Ketones and Carboxylic Acids	<ol style="list-style-type: none"> 1. 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. 2. Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.
Unit - 14	Organic Compounds Containing Nitrogen	<ol style="list-style-type: none"> 1. Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines. 2. Cyanides and Isocyanides – will be mentioned at relevant places in context. 3. Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry
Unit - 15	Hydrocarbons	<ol style="list-style-type: none"> 1. Classification of Hydrocarbons. Aliphatic Hydrocarbons: Alkanes – Nomenclature, isomerism, conformations (ethane only), physical properties. 2. Chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis. 3. Alkenes– Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation. 4. Chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect). 5. Ozonolysis, oxidation, mechanism of electrophilic addition. Alkynes – Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of - hydrogen, halogens, hydrogen halides and water. 6. Aromatic hydrocarbons – Introduction, IUPAC nomenclature; Benzene: resonance, aromaticity; chemical properties.

		7. Mechanism of electrophilic substitution – nitration sulphonation, halogenation, Friedel Craft’s alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity.
Unit - 16	Bio-molecules	<ol style="list-style-type: none"> 1. Carbohydrates - Classification (aldoses and ketoses), monosaccharides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen) importance. 2. Proteins - Elementary idea of α - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure. 3. Vitamins - Classification and functions. 4. Nucleic Acids: DNA and RNA.
Unit - 17	Chemistry in Everyday life	<ol style="list-style-type: none"> 1. Chemicals in medicines - analgesics, tranquilizers antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines. 2. Chemicals in food - preservations, artificial sweetening agents, elementary idea of antioxidants. 3. Cleansing agents - soaps and detergents, cleansing action.
Unit - 18	Environmental Chemistry	<ol style="list-style-type: none"> 1. Environmental pollution – Air, water and soil pollution. 2. Chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain. 3. Ozone and its reactions, effects of depletion of ozone layer. 4. Greenhouse effect and global warming – pollution due to industrial wastes. 5. Green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution.

Mathematics Syllabus		
Unit	Unit Title	Syllabus
Unit – 1	Sets, Relations & Functions	<ol style="list-style-type: none"> 1. Sets 2. Sets and their Representations 3. Types of sets, Venn Diagrams, Operations on Sets, Complement of a Set 4. Union and Intersection of Two Sets 5. Cartesian Product of Sets 6. Relation 7. Functions 8. Types of Relations 9. Types of Functions 10. Composition of Functions and Invertible Function 11. Binary Operations
Unit – 2	Trigonometry and Inverse Trigonometric Functions	<ol style="list-style-type: none"> 1. Angles 2. Trigonometric Functions 3. Trigonometric Functions of Sum and Difference of Two Angles 4. Trigonometric Equations 5. Basic Concepts of Inverse Trigonometric Functions 6. Properties of Inverse Trigonometric Functions
Unit – 3	Principle of Mathematical Induction	<ol style="list-style-type: none"> 1. Motivation 2. The Principle of Mathematical Induction
Unit – 4	Complex Numbers & Quadratic Equations	<ol style="list-style-type: none"> 1. Complex Numbers 2. Algebra of Complex Numbers 3. The Modulus and the Conjugate of a Complex Number 4. Argand Plane and Polar Representation 5. Quadratic Equations
Unit – 5	Matrices & Determinants	<ol style="list-style-type: none"> 1. Matrix 2. Types of Matrices 3. Operations on Matrices 4. Transpose of a Matrix 5. Symmetric and Skew Symmetric Matrices 6. Elementary Operation of a Matrix 7. Invertible Matrices 8. Determinants 9. Determinant 10. Properties of Determinants 11. Area of a Triangle 12. Minors and Cofactors 13. Adjoint and Inverse of a Matrix 14. Applications of Determinants and Matrices
Unit – 6	Permutations & Combinations Statistics & Probability	<ol style="list-style-type: none"> 1. Fundamental Principle of Counting 2. Permutations 3. Combinations 4. Measures of Dispersion 5. Range 6. Mean Deviation 7. Variance and Standard Deviation 8. Analysis of Frequency Distributions

		<ol style="list-style-type: none"> 9. Random Experiments 10. Event 11. Axiomatic Approach to Probability 12. Conditional Probability 13. Multiplication Theorem on Probability 14. Independent Events 15. Bayes' Theorem 16. Random Variables and its Probability Distributions 17. Bernoulli Trials and Binomial Distribution
Unit – 7	Mathematical Reasoning	<ol style="list-style-type: none"> 1. Statements 2. New Statements from Old 3. Special Words/Phrases 4. Implications 5. Validating Statements
Unit – 8	Binomial Theorem, Sequence & Series	<ol style="list-style-type: none"> 1. Binomial Theorem for Positive Integral Indices 2. General and Middle Terms 3. Sequences 4. Series 5. Arithmetic Progression (A.P.) 6. Geometric Progression (G.P.) 7. Relationship between A.M. and G.M. 8. Sum to n terms of Special Series
Unit – 9	Straight Lines and Conic Sections	<ol style="list-style-type: none"> 1. Slope of a Line 2. Various Forms of the Equation of a Line 3. General Equation of a Line 4. Distance of a Point From a Line 5. Sections of a Cone 6. Circle 7. Parabola 8. Ellipse 9. Hyperbola
Unit – 10	Limit, Continuity, Differentiability and Application of Derivatives	<ol style="list-style-type: none"> 1. Limits 2. Limits of Trigonometric Functions 3. Continuity 4. Differentiability 5. Exponential and Logarithmic Functions 6. Logarithmic Differentiation 7. Derivatives of Functions in Parametric Forms 8. Second Order Derivative 9. Mean Value Theorem 10. Rate of Change of Quantities 11. Increasing and Decreasing Functions 12. Tangents and Normals 13. Approximations 14. Maxima and Minima
Unit – 11	Integral Calculus and Application of Integrals	<ol style="list-style-type: none"> 1. Integration as an Inverse Process of Differentiation Methods of Integration 2. Integrals of some Particular Functions 3. Integration by Partial Fractions 4. Integration by Parts

		<ol style="list-style-type: none"> 5. Definite Integral 6. Fundamental Theorem of Calculus 7. Evaluation of Definite Integrals by Substitution 8. Some Properties of Definite Integral 9. Area under Simple Curves 10. Area between Two Curves
Unit – 12	Differential Equations	<ol style="list-style-type: none"> 1. Basic Concepts 2. General and Particular Solutions of a Differential Equation 3. Formation of a Differential Equation whose General Solution is given 4. Methods of Solving First order, First Degree Differential Equations
Unit – 13	Vector Algebra	<ol style="list-style-type: none"> 1. Some Basic Concepts 2. Types of Vectors 3. Addition of Vectors 4. Multiplication of a Vector by a Scalar 5. Product of Two Vectors
Unit – 14	Three Dimensional Geometry	<ol style="list-style-type: none"> 1. Coordinate Axes and Coordinate Planes in Three Dimensional Space 2. Three Dimensional Space 3. Coordinates of a Point in Space 4. Distance between Two Points 5. Section Formula 6. Direction Cosines and Direction Ratios of a Line 7. Equation of a Line in Space 8. Angle between Two Lines 9. Shortest Distance between Two Lines 10. Plane 11. Coplanarity of Two Lines 12. Angle between Two Planes 13. Distance of a Point from a Plane 14. Angle between a Line and a Plane
Unit – 15	Linear Inequalities and Linear Programming	<ol style="list-style-type: none"> 1. Inequalities 2. Algebraic Solutions of Linear Inequalities in One Variable and their Graphical Representation 3. Graphical Solution of Linear Inequalities in Two Variables 4. Solution of System of Linear Inequalities in Two Variables 5. Linear Programming Problem and its Mathematical Formulation 6. Different Types of Linear Programming Problems

Aptitude & Logical Reasoning		
Unit	Unit Title	Syllabus
Unit – 1	Verbal Reasoning	1. Analogy 2. Classification 3. Series Completion 4. Coding-Decoding 5. Blood-Relation 6. Puzzle Test 7. Sequential Output Tracing 8. Direction Sense Test 9. Logical Venn Diagram 10. Alphabet Test 11. Number Ranking and Time Sequence Test 12. Mathematical Operations 13. Logical sequence of words 14. Arithmetical Reasoning 15. Inserting Missing Characters 16. Data Sufficiency 17. Decision Making 18. Assertion and Reason 19. Situation Reaction Test 20. Verification of truth of statements
Unit – 2	Logical Reasoning	1. Logic 2. Statement- Argument 3. Statement- Assumption 4. Statement- Course of Action 5. Statement- conclusion 6. Deriving conclusions from the passage 7. Theme detection 8. Question- Statement 9. Miscellaneous Logical Puzzle
Unit – 3	Non- Verbal reasoning	1. Series 2. Analogy 3. Classification 4. Analytical Reasoning 5. Mirror Images 6. Water Images 7. Embedded Figures 8. Completion of incomplete pattern 9. Figure Matrix 10. Paper Folding 11. Paper Cutting 12. Rule Detection 13. Grouping of Identical Figure 14. Cubes and Dice 15. Dot Situation 16. Construction of square and triangles 17. Figure formation and analysis

English Syllabus		
Unit	Unit Title	Syllabus
Unit – 1	English as language (Matriculation level)	1. Vocabulary Usage 2. Comprehensive Ability 3. Selecting Phrases 4. Error Detection 5. Rearrangement 6. General Usage