উদ্ভাস
একাডেমিক এন্ড এডমিশন কেয়ার

HSC 1st Year একাডেমিক প্রোগ্রাম পাইওনিয়ার ব্যাচ

Syllabus

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Serial No.	Subject	Chapter	Lecture
1	Physics 1st Paper	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	66
2	Chemistry 1st Paper	1, 2, 3, 4, 5	56
3	H.Math 1st Paper	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	88
4	Biology 1st Paper	1, 2, 3, 4, 5, 6, 7	34
5	Biology 2nd Paper	1, 2, 3, 4, 5, 6	32
		Total: 38	**Total: 276**

Physics 1st Paper		
Chapter	**Lecture**	**Lecture-based discussion topics**
Chapter-1 Physical World and Measurement	P-01	Scope of physics, Physics and other branches of science, Evolution of physics, Concepts, formulas, principles, postulates, hypotheses and theories in Physics, Measurement, Units, dimensions, dimensional equations, principle of symmetry, conversion of physical quantities from one unitary system to another, limitations of dimensional equations, errors, mechanical errors, observational errors, random or scattered errors, repetitive errors, Least Count errors, calculation of errors, determination of accurate values of measured quantities, significant figures.
	P-02	Error calculation (proof, percentage, relative), mathematical problems related to errors, Some measuring instruments, Vernier scale, Slide calipers, Screw-gauge, Spherometer, Weighing machine, Mathematical problems
Chapter-2 Vector	P-03	Quantities, Scalar quantities and vector quantities, Expression of vector quantities, Different types of vectors, Addition of vectors: Resultant, Triangle formula, polygon formula
	P-04	Law of parallelogram, Magnitude of the Resultant of two vectors, determination of the direction of the resultant, some special cases of the Law of parallelogram. Concept of vector in Cartesian coordinate system.
	P-05	Some properties of vector addition, commutative formula, conjunction formula, distributive formula, components of vectors, finding the product of more than two vectors using components.
	P-06	uses of vector components, Towing a Boat, lawn roller, river and boat concepts.
	P-07	CQ & Admission Standard Questions related to River and Boat
	P-08	Vector Subtraction, Relative velocity.
	P-09	addition and subtraction of vectors resolution in components, CQ & Admission Standard Problems on relative velocity
	P-10	Determining position vectors, vectors in three-dimensional coordinate systems, product of vectors, product of vectors with scalar quantities
	P-11	Dot product of vectors, CQ & Admission standard problems
	P-12	Cross product of vectors, CQ & Admission standard problems
	P-13	Calculus, differentiation, integration, functions with multiple variables, and partial differentiation.
	P-14	Scalar and vector fields, gradient, divergence, curl.
Chapter-3 Dynamics	P-15	Frame of reference, Rest and motion, distance and displacement, average velocity and average speed, instantaneous velocity and instantaneous speed, acceleration, equations of motion for uniform acceleration in one dimension.
	P-16	CQ & Admission Standard Problems on Equation of Motion, Describing Motion with the help of graphs, Concepts of slope and area in describing motion
	P-17	Motion of free-falling bodies, vertical motion, equations for thrown body, Galileo's laws derived from the equations of motion.
	P-18	CQ & Admission Standard Problems related to Vertical Motion, Motion of objects along curved paths, vector representation of equations of motion for uniformly accelerated motion, projectile motion, equation of projectile trajectory, equations related to projectile.
	P-19	CQ & Admission Standard Problems related to projectile motion.
	P-20	Circular motion, Various quantities related to circular motion, centripetal acceleration, centripetal acceleration formulae, net acceleration, angular equations of motion.
Chapter-4 Newtonian Mechanics	P-21	Basic concepts of force, Newtonian mechanics, Newton's first law of motion, inertia of motion and rest, definition and characteristics of force, different types of forces, fundamental forces, gravitational force, electromagnetic force, strong nuclear force, weak nuclear force, Force balance
	P-22	Momentum, Newton's second law of motion, equilibrium of forces. CQ & Admission Standard Problems. Impulsive force and impulsive of force, Newton's third law of motion.
	P-23	system of forces, external and internal forces, types of forces, gravitational force, normal force, weight of an object, tension.
	P-24	Friction, angle of friction, limiting angle.
	P-25	Conservation of momentum, vector representation of conservation of momentum, collision, formulas for one-dimensional elastic collision.
	P-26	Center of mass, impulse and impact force, applicability and applications of Newton's laws, standing on the ground, walking, pulling a horse cart, towing a boat, space missions and rocket motion, interrelation of Newton's laws of motion.
	P-27	CQ & Admission Standard Problems to moment of inertia, torque, quantities for torque, vector representation of torque, torque and angular acceleration
	P-28	Uniform circular motion, centripetal force, centrifugal force, banking of curved roads for vehicles (bicycles, trains, motor vehicles).
	P-29	Rotational inertia: moment of inertia, radius of gyration, perpendicular axis theorem, parallel axis theorem.

	P-30	Angular momentum, equivalent methods for calculating angular momentum, angular momentum of a rotating object in circular motion, relationship between torque (τ) and angular momentum ($\vec{L}$), Newton's laws for rotational motion, applications of Newton's laws in rotational motion, mathematical problems.
Chapter-5 Work, Energy and Power	P-31	Work, positive, negative, and zero work, constant and variable force, work done by a constant force.
	P-32	Work done by a variable force, spring force, work done in rotational motion, displacement of the center of mass and mathematical problems.
	P-33	CQ & Admission Standard mathematical problems related to center of mass displacement, dependency of work done on the path, kinetic energy and work-energy theorem, kinetic energy of a rotating object, kinetic energy of an object undergoing both translational and rotational motion.
	P-34	Conservative forces, non-conservative forces, potential energy, gravitational potential energy, elastic potential energy, relationship between potential energy and force.
	P-35	Problems related to potential energy and kinetic energy, Changes in work done and mechanical energy, conservation of mechanical energy, principle of conservation of energy.
	P-36	Power, efficiency, mathematical problems, and problems related to work done, wells and cisterns.
Chapter-6 Gravitation and Gravity	P-37	Falling objects, Kepler's laws of planetary motion, gravitation, vector representation of gravitational force, inertial mass and gravitational mass, gravity and gravitational acceleration.
	P-38	Determination of g: relationship between gravitational constant and gravitational acceleration, variations in gravitational acceleration, changes in g due to the shape of the Earth, variation of g with altitude, variation of g with depth from the Earth's surface, variation of g due to Earth's rotation.
	P-39	Center of gravity, gravitational field, gravitational field intensity.
	P-40	Gravitational potential, relationship between gravitational field intensity and gravitational potential, gravitational potential energy, applications of the law of gravitation, application of the law of gravitation in hollow spheres, application of the law of gravitation in solid spheres.
	P-41	Escape velocity, Relationship between Newton's law of gravitation and Kepler's laws, applications of the law of gravitation.
	P-42	Satellite motion, quantities related to, geostationary satellites, polar satellites, applications of the law of gravitation: weightlessness in space, applications of the law of gravitation: exploration of natural resources and material research.
Chapter-7 Structural Properties of Matter	P-43	Intermolecular forces, intermolecular forces in solids, intermolecular forces in liquids, intermolecular forces in gases, bonding, intermolecular forces and elasticity of materials, intermolecular attraction and repulsion forces, potential energy, analysis of graphs, analysis of potential energy graphs, summary of graphs, quantities related to elasticity.
	P-44	Elasticity-based classification of materials, deformation, stress, types of deformation, types of stress, Hooke's law, elastic constants and general mathematical problems, relationships among different elastic constants.
	P-45	CQ & Admission Standard mathematical problems related to elastic constants, elastic potential energy, Poisson's ratio.
	P-46	Laminar and turbulent flow, viscosity, friction and viscosity, effects of pressure and temperature on viscosity, terminal velocity and Reynolds number, Stokes' law, terminal velocity,
	P-47	Surface tension, factors affecting surface tension of liquids.
	P-48	Surface energy, capillarity, and mathematical problems.
Chapter-8 Periodic Motion	P-49	Periodic motion, spatial periodicity, temporal periodicity, characteristics of periodic motion, oscillatory motion, simple harmonic motion, ideal spring, spring constant, motion of a mass attached to an ideal spring, conditions for simple harmonic motion, differential equation of simple harmonic motion, parameters of simple harmonic motion.
	P-50	Relation between simple harmonic motion and circular motion, displacement in simple harmonic motion, solution of the differential equation of simple harmonic motion, relation between velocity and acceleration, mathematical problems.
	P-51	CQ & Admission Standard mathematical problems related to displacement, velocity, and acceleration in simple harmonic motion, graphs of simple harmonic motion.
	P-52	Energy associated with simple harmonic motion, potential energy stored in spring, energy variation with time, graph of energy vs. displacement.
	P-53	Applications of simple harmonic motion, oscillation in the vertical plane, combined oscillations in springs, motion of a simple pendulum, derivation of the time period formula for a simple pendulum.
	P-54	Applications and mathematical problems related to the simple pendulum.
Chapter-9 Wave	P-55	Waves, mechanical waves, origin of different mechanical waves, transverse waves, longitudinal waves, electromagnetic waves, waves and energy, different wave parameters and equations, medium transition.
	P-56	Progressive waves, equation of progressive waves, phase difference and path difference in progressive waves.
	P-57	Wave interference, stationary waves.
	P-58	Beats or sound modulation.
	P-59	Free and forced vibrations, resonance, wave intensity, standard intensity and intensity level, harmonics and sound spectrum, audible sound, musical notes and tones.
	P-60	Vibration in a stretched string, vibration in air columns, and mathematical problems.
Chapter-10 Ideal gas and kinetics of gases	P-61	Gases, pressure of gases, volume of gases, temperature of gases, number of gases, gas laws, relationship between pressure and volume, relationship between volume and temperature, Boyle's law or pressure law.
	P-62	Ideal gases, properties of ideal gases, real gases, fundamental assumptions of the kinetic theory of gases.
	P-63	Kinetic molecular theory of gases, applications of kinetic theory, Different types of velocities of gas molecules, mean free path,
	P-64	Degrees of freedom, Monatomic gases, diatomic gases, polyatomic gases, linear polyatomic gases, nonlinear polyatomic gases, principle of equipment of energy
	P-65	Water vapor and atmospheric pressure, gases and vapors, evaporation, condensation, saturated and unsaturated vapor pressure, relationship between vapor pressure and volume at constant temperature, relationships among different parameters of water vapor, dew point and relative humidity. Common mathematical problem

	P-66	Humidity measuring instruments and humidity determination, description of wet and dry bulb hygrometer, working principle of wet and dry bulb hygrometer, CQ & Admission Standard Mathematical Problems on Relative Humidity and Dew Point, some phenomena related to hygrometry.

Chemistry 1st Paper		
Chapter	**Lecture**	**Lecture-based discussion topics**
Chapter-1 Safe Use of Laboratory	C-01	Safe use of Laboratory- Aprons, masks, safety glasses, gloves, lab rules/golden rules, Solvent measuring device and its uses- Chemical analysis, test tubes, beakers, burettes, pipettes, volumetric flasks, conical flasks, wash bottles, measuring cylinders, techniques for cleaning glassware, Concentration- Molarity, Molality, Dilution, Standard Substances (Primary & Secondary) + Math
	C-02	Titration- Method, Indicator, End Point & Equivalent Point, Formulation of Titration Equations + Math.
	C-03	Solute measuring instruments - chemical instruments, Paul-Bunge balances, method of weighing in balances, digital balances, Heating Techniques with Laboratory Apparatus- Bunsen Burner & Flame, Heating Techniques in Round Bottom Flasks, Conical flask heating technique, Water bath heating technique, Porcelain bowl heating technique, Test tube heating technique, Beaker heating technique. Storage, Use, Precautions and Disposal of Chemicals- Storage of Chemicals, Waste Management, Use and Precautions of Chemicals.
	C-04	Effects of Chemicals on Environment and Moderate Use - Environmental Pollution by Airborne Substances, Environmental Pollution by Laboratory Solid and Liquid Substances, Effects of chemicals on Environment and Health, moderate use of chemicals, analytical methods (macro, semi-micro, micro), laboratory safety equipment and rules of use - fume hood, blanket, laboratory kit, eyecup, sink, use of fire extinguisher, first aid box, first aid and Use of first aids.
Chapter-2 Qualitative Chemistry Introduction	C-05	Fundamental particles of atoms, introduction- electron, proton and neutrons discussion, atomic mass unit, atomic expression, isotope, isotone, isobar, isoelectronic, isomer, Radioactive isotope and nuclear reaction (Transmutation, fission and fusion)
	C-06	Atomic models- Rutherford's atomic model discussion.
	C-07	Atomic models- Bohr's atomic model discussion.
	C-08	Application of atomic models and Quantum Mechanics-Derivation for v, r, n, E from Bohr's model, Related Math, De Broglie's equation, Heisenberg's uncertainty principle, Schrodinger's wave equation, Related Math.
	C-09	De Broglie's equation, Heisenberg's uncertainty principle, Schrodinger's wave equation, Related Math. Orbit and Orbital Discussion, Quantum Subshell shapes and discussion.
	C-10	Electromagnetic spectrum- Discussion, quantities related to radiation, regions of electromagnetic ray, classification of spectrum, identification of compounds using spectrum.
	C-11	Quantum Number- Principal Quantum number, Subsidiary Quantum Number, Magnetic Quantum Number, Spin Quantum Number, Significance of Quantum Number
	C-12	Electronic Configuration- Aufbau Principle, Hund's Rule, Pauli's Exclusion Principle, e^- configuration of compounds and ions, stability of electronic configuration.
	C-13	spectrum of H atom + Rydberg Discussions, Related Math.
	C-14	Lines of spectrum, Uses of UV in fake money and passport identification, Uses of IR ray in medical science, Use of MRI in diagnosis.
	C-15	Solubility and Solubility Product- Mixture and Solution, Solubility, Factors influencing solubility.
	C-16	solubility products, ionic product, Related Math.
	C-17	Principle of Solubility Product, Application of the principle of Solubility Product Common ion and its effect to change solubility
	C-18	Application of common ion, effect of pH on solubility, Related Math.
	C-19	Qualitative Analysis (Ion identification)- Flame test, wet test (+ve and –ve ion identification)
	C-20	Applications of Qualitative Chemistry (Physical Analysis)- crystallization, distillation and partial distillation, steam distillation, sublimation, low pressure distillation.
	C-21	Nernst's distribution formula, solvent extraction.
	C-22	chromatography, column chromatography, thin layer chromatography, paper chromatography, importance of qualitative analysis.
Chapter-3 Periodic Properties and Bonding in Elements	C-23	History, idea and significance of periodic table, Classification of elements based on e^- configuration, Block elements (s, p, d, f) characteristics.
	C-24	Chemical properties of block elements (Chemical properties of **s** block elements).
	C-25	Chemical properties of block elements, Chemical properties of p block elements, (Group-13, 14, 15).
	C-26	Chemical properties of block elements, Chemical properties of p block elements, (Group-16, 17, 18).
	C-27	Periodic properties- atomic size, Ionization energy, Electron affinity, Electronegativity
	C-28	Ligand, Coordinate covalent bond, Acidity/Basicity of oxides.
	C-29	Chemical properties of block elements (Chemical properties of d block elements, Chemical properties of **f** block elements).
	C-30	Transitional Element, Properties of transitional element (Except for the effects of transition metals and the nomenclature of complex compounds.
	C-31	Melting point/Boiling point (2nd period, 3rd period, d- block), Effects of Transition Metals, Naming of Complex Compounds.
	C-32	Chemical Bonds- Ionic bond, Metallic bond, Covalent bond, Classification of covalent bond, Lewis dot structure.
	C-33	Orbital overlapping. Hybridization, Classification of Hybrid orbitals.
	C-34	Determination of Hybridization state of central atom, Relation between Shapes of covalent compounds and hybrid orbitals, Effect of lone pair electrons on Molecular shapes.
	C-35	Effect of electronegativity on compounds with chemical bonds- Polarization or deformation of ion, Covalent properties in ionic compounds, Fajan's rule, Effect of polarization on salt.
	C-36	Weak chemical bonds- Vander Waals force, H bond, Importance of H bond, Naming of inorganic compounds.

Chapter-4 Chemical Changes	C-37	Chemical Reaction and Rate of Reaction- Green Chemistry, Reaction Direction:(Irreversible Reaction and Reversible reaction), Rate of reaction.
	C-38	Rate constant
	C-39	Order of reaction, molecularity of reaction
	C-40	Effect of temperature on rate of reaction (Arrhenius equation), Activation energy, Collision theory.
	C-41	Effect of Pressure on rate of reaction, Effect of concentration on rate of reaction, Effect of catalyst on rate of reaction. Equilibrium of chemical reaction and its Dynamics.
	C-42	Le-Chatelier's Principle Effect of temperature, pressure and concentration on equilibrium, Use in industry (Le-Chatelier's Principle).
	C-43	Derivation of mathematical expression of K_p and K_c
	C-44	Derivation of mathematical expression of K_p and K_c
	C-45	Mathematical Problem of K_p and K_c
	C-46	Acid-Base equilibrium- Theories related to acid-base, Ionic product of water
	C-47	Dissociation constant of acid-base, Degree of dissociation, Acid-Base strength.
	C-48	pH & pOH.
	C-49	Buffer solution, Mechanism of buffer solution.
	C-50	Mathematical problems of buffer solution.
	C-51	Thermochemistry- Law of conservation of mass and energy, Thermochemical equation, Heat of reaction.
	C-52	Bond energy, Lavoisier and Hess's law, determining heat of reaction using Lavoisier and Hess's law.
Chapter-5 Vocational Chemistry	C-53	Food Safety- (Chemistry in enhancing food production, Importance of various elements as fertilizers, Role of chemistry in food preservation, Drying method of foodstuff, Cooling method of foodstuff).
	C-54	Food Preservatives- (Natural Food Preservatives, Artificial Food Preservatives, Anti-Microbial Agents, Antioxidants, Vinegar).
	C-55	Food Fractionation- (Stages of Fractionation Fruit Fractionation, Vegetable Fractionation, Fish Fractionation).
	C-56	Mixture- (Colloid, Colloid filtration, Suspension, Preparation of Butter from Milk), Toiletries & Perfumeries- Rose water preparations, hair oil preparations, telecom powder preparations, vanishing cream preparations, cold cream preparations, lipstick preparations, after shave preparations, henna extract), Cleaners and detergents- (glass cleaner, toilet cleaner).

H.Math 1st Paper		
Chapter	**Lecture**	**Lecture-based discussion topics**
Chapter-1 Matrix & Determinant	HM-01	Exercise - 1.1; Types of matrix, problems related to types of matrix.
	HM-02	Exercise - 1.1; Addition and subtraction of matrix, problems related to addition and subtraction of matrix, equality of matrix, problems related to equality of matrix. Scalar multiplication of matrices.
	HM-03	Exercise - 1.1; Matrix multiplication, problems related to matrix multiplication, matrix exponential,
	HM-04	Exercise - 1.1; Problems related to matrix polynomials, Some special matrices, properties of some special matrix related to trace, matrix in real life, matrix problems based on real life.
	HM-05	Exercise - 1.2; Minors and co-factors of determinant, singular and non-singular matrix and problems related to singular and non-singular matrix.
	HM-06	Exercise - 1.2; Inverse matrix, problems related to inverse matrix, properties of determinant.
	HM-07	Exercise - 1.2; Problems related to proof of identity with determinants, proof without expansion.
	HM-08	Exercise - 1.2; Solving equations with determinants, Solving systems of equations - Cramer's rule, solving systems of equations - Inverse matrix method, Problems related to solving systems of equations, Special formula related to the magnitude of determinants.
Chapter-2 Vector	HM-09	Exercise - 2; Quantities, vectors, types of quantities or different types of vectors, vector addition, vector subtraction, internal and external division of a segment between two points, geometric proof problems using the concept of vector addition and subtraction.
	HM-10	Exercise - 2; Vector division (components of a vector), projection and component, expressing of a vector in a two-dimensional Cartesian coordinate system, expressing a vector in a three-dimensional Cartesian coordinate system, Problems related to addition and subtraction of vectors and determination of magnitude, determination of unit vectors in the direction, opposite direction or parallel to a vector, vector multiplication, multiplication of a vector quantity by a scalar quantity, dot multiplication of vectors (scalar multiplication) Problems related to dot product of vectors and perpendicularity of two vectors.
	HM-11	Problems related to a vector lying in the same plane of another two vectors, problems related to determining the angle between two vectors, perpendicular projection of vectors and determination of components, vector/cross multiplication of vectors, cross product of vectors and problems related to two vectors being parallel.
	HM-12	Exercise - 2; Unit vector perpendicular to a plane formed by two vectors, some information about area, using vectors, problems related to finding the area of a polygon, volume of a cube and the condition for three vectors to be co-planar, vectors and Cartesian equations of a straight line in three-dimensional coordinate system, vectors and Cartesian equations of a straight line through two given points.
Chapter-3 Straight Line	HM-13	Exercise – 3.1; Coordinate system and distance between two points, Cartesian coordinate system, polar coordinate system, transformation of coordinate systems.
	HM-14	Exercise – 3.1; Distance between two points, Problems related to distance between two points.
	HM-15	Exercise – 3.2; Division formula, related to coordinates of point of internal division / external division.
	HM-16	Exercise – 3.2; Related to parallelogram/square/triangle/circle, Exercise – 3.3; Area of polygon, Determining the area of a triangle by the coordinates of the vertices of a triangle.
	HM-17	Exercise – 3.3; Shifting parallel axes, Determining the area, Conditions for three points to be collinear, Determining the ratio of division of one line segment by another.

	HM-18	Exercise – 3.4; Locus, Determining the equation of locus.
	HM-19	Exercise – 3.5; Problems related to slope and equation of a straight line.
	HM-20	Exercise – 3.5; Related to the condition that two equations they refer to the same straight line, Conversion from general equation of a straight line to equations of different forms, Intersection of two straight lines, Area related.
	HM-21	Exercise – 3.5; locus related. Exercise – 3.6; Related to condition for three straight lines to be congruent, related to two parallel straight lines, related to parallel straight lines of a straight line.
	HM-22	Exercise – 3.6; Related to two perpendicular straight lines, related to equation of a straight line to the intersection of two straight lines.
	HM-23	Exercise – 3.6; Internal angle between two straight lines, Different types of centers.
	HM-24	Exercise – 3.7; Perpendicular distance of a given straight line from a given point, Position of a point with respect to a straight line
	HM-25	Exercise - 3.7; Bisection of a line segment joining two points, perpendicular distance between two parallel straight lines,
	HM-26	Exercise - 3.7; Equation of the bisector of an angle between two non-parallel straight lines, Determining the equation of the bisector of an angle under different conditions, image related
Chapter-4 Circle	HM-27	Exercise - 4.1; Concept of circle, equation of a circle with center at origin and radius r, equation of a circle with given center and radius, general equation of a circle, some properties of general equation of a circle / condition of equation of a circle, signs of g and f in different quadrants, classification of circle.
	HM-28	Exercise - 4.1; Position of a point with respect to the circle, Determination of the equation of a circle using terminal points of diameter, Determining the end points of diameter of a circle, Equation of circle when its center and any point on the circumference is given.
	HM-29	Exercise - 4.1; Intersection of axes by circle and regarding touches the axes, Equation of circle not touching or intersecting any of the axes.
	HM-30	Exercise - 4.1; Equation of a circle passing through the intersection of a straight line/circle and another circle, Equation of a circle passing through three fixed points, Equation of a circle centered on a fixed straight line.
	HM-31	Exercise - 4.1; Regarding the circumference and the incircle, Exercise - 4.2; Equation of tangent and perpendicular to a circle at a fixed point.
	HM-32	Exercise - 4.2; Problems related to tangent drawn from a point outside the circle, Determining the length of a chord of a circle.
	HM-33	Exercise - 4.2; Mutual position of two circles, fundamental axis and common chord.
	HM-34	Exercise - 4.2; Determining the number of common tangents of two circles and their equations, Polar equation of a circle, Parametric equation of a circle.
Chapter-5 Permutations and Combinations	HM-35	Exercise – 5.1; Addition and multiplication rules of counting, permutation, use of factorial and ${}^{n}P_{r}$ formula.
	HM-36	Exercise – 5.1; permutation of objects that are not all different, total arrangement of all n different letters (things), permutation of such cases where repetitions can occur, in such cases permutation, How many letters (or objects) can be put together or not, How many specific letters (or objects) can never be put together, the position of a letter (or object) is fixed.
	HM-37	Exercise – 5.1; Regarding rearrangement, certain letters (or objects) will not change the order Change in relative position of certain letters (or objects), permutation of certain letters from words with different letters, formation of numbers of certain digits, formation of odd numbers, formation of even numbers, numbers smaller and greater than a certain number.
	HM-38	Exercise – 5.1; Cycle permutation, Exercise – 5.2; Combination, difference between permutation and combination, complementary combination, problems related to the use of ${}^{n}C_{r}$ formula, selection related.
	HM-39	Exercise – 5.1; Conditional combination-including or excluding a certain number of objects, Exercise – 5.2; Word formation through combination, Exercise – 5.2; formation of groups or committees.
	HM-40	Determination of generative number, formation of straight lines, triangles, polygons, diagonals and planes from points, Determination of intersection point, division into groups or groups, problems related to division into groups or groups, divisibility.
Chapter-6 Trigonometric Ratios	HM-41	Exercise – 6; Types of trigonometry, Quadrilateral, Two-dimensional angle, Measurement of two-dimensional angle, Radian angle is a constant angle, Relationship between degree and radian, Three-dimensional angle and its measurement, Problems related to mutual conversion of sexagesimal, circular and centigrade systems of angles, Determination of the length of arc of a circle, Determination of the area of a circle.
	HM-42	Exercise – 6; Angle between the hour and minute hands of a clock, Interior angle of a polygon, Similar triangle, Ratio of trigonometric angles, Fundamental theorem, Trigonometric ratio of axial angle, Relationship between ratios of trigonometric angles.
	HM-43	Exercise – 6; Problems related to mutual conversion of trigonometric ratios and determination of value, Problems related to proof, Problems related to trigonometric identities, Circular function and its domain-range.
	HM-44	Exercise – 6; Graphs of trigonometric functions, graph related problems, period of trigonometric functions, various changes in the graph of trigonometric functions, determination of fundamental period.
Chapter-7 Trigonometric Ratios of Associated and Compound Angles	HM-45	Exercise – 7.1; Trigonometric ratio of θ or positive acute angle: (-θ) or negative angle: (90° – θ), i.e. trigonometric ratio of angle θ: Co-function: Trigonometric ratio of angle (90° + θ), (180° – θ), (180° +θ), (270° - θ), (270° + θ), Trigonometric quantities
	HM-46	Exercise – 7.1; problems involving associated angles, Problems related to sum of squares of trigonometric ratios, Multiplication and problems of Tangent or Cotangent ratios, Determination of values and problems using various trigonometric formulas.
	HM-47	Exercise - 7.2; Trigonometric ratio of compound angles, A and B are positive acute angles where A > B, Problems related to trigonometric ratios.
	HM-48	Exercise – 7.2; A ± B related formulae and problems, problems related to trigonometric expansions, problems related to $\frac{\cos A \pm \sin A}{\cos A \mp \sin A}$ formula, problems related to A + B = constant, Finding the maximum/minimum value of a trigonometric expression.

	HM-49	Exercise – 7.3; Formulae and problems related to $\sin(A+B) \pm \sin(A-B)$ or $\cos(A+B) \pm \cos(A-B)$, Problems related to $TF_1C \pm TF_2D$, problems related to $\sin A + \cos A$.
	HM-50	Exercise – 7.4; Trigonometric ratios of multiple angles, formulae and problems for trigonometric ratios of 2A angles, series related (arithmetic and geometric series) and problems.
	HM-51	Exercise - 7.4; Problems related to periodic square roots, Trigonometric ratios of 3A angles and problems, Trigonometric ratios of specific angles.
	HM-52	Exercise – 7.5; Formulae and problems related to proof, Problems related to determining the values of various trigonometric ratios from the values of $\cos x + \cos y$ and $\sin x + \sin y$.
	HM-53	Exercise – 7.6; Problems related to tangent and cotangent, problems related to sine and cosine.
	HM-54	Exercise – 7.7; Sine law of a triangle, law of tangents, problems related to law of tangent.
	HM-55	Exercise – 7.7; Cosine law, related to cosine law of a triangle, perpendicular projection, perpendicular projection related.
	HM-56	Exercise – 7.7; progression related, trigonometric ratios of half angles of a triangle and formulae, Area of a triangle related, relationship between the in-radius and the circumradius: Area related, determining the nature of a triangle based on conditions, others.
Chapter-8 Functions and Graph of Functions	HM-57	Exercise – 8; Sets and their variations, applications, set mapping and Cartesian properties. finitary relations, functions and their identification, clear concept of functions with the help of mapping, domain, range and codomain, role of variables and constants in functions, functions and graphs of functions, Piecewise Function.
	HM-58	Exercise – 8; Problems related to determining the value of functions, One-one function and many-one function, Onto function, Bijective function.
	HM-59	Exercise – 8; Inverse function and inverse relation, discussion on inverse function, domain-range determination method
	HM-60	Exercise – 8; Transformation of functions and relations, transformation of graphs, change in shape of graphs, reflection of graphs, symmetry of graphs.
	HM-61	Exercise – 8; Various functions related to square roots, rational functions $\left(f(x) = \frac{P(x)}{Q(x)}\right)$, n-th root related functions, absolute value related functions, exponential functions $(y = a^x;\ a > 0, a \neq 1)$, logarithmic functions,
	HM-62	Exercise – 8; Determining the Domain range related, adjoint functions.
Chapter-9 Differentiation	HM-63	Exercise - 9.1; Basic concepts of limits, undefined, infinite, existence of limits,
	HM-64	Exercise - 9.1; Limits, basic theorems of limits, Existence of limits and general limits, factor analysis related, related to multiplying denominator and numerator of $\lim_{x\to a} \frac{x^n-a^n}{x-a}$ by conjugate.
	HM-65	Exercise - 9.1; Limits at infinite points and infinite limits, some special limits; Infinite limits related. $\lim_{x\to 0} \frac{\sin x}{x}$; $\lim_{x\to 0} \frac{\tan x}{x}$
	HM-66	Exercise - 9.1; $\lim_{x\to 0} (1+x)^{\frac{1}{x}}$; $\lim_{x\to\infty} \left(1+\frac{1}{x}\right)^x$ related., Series related; Continuity of functions, Sandwich theorem.
	HM-67	Exercise - 9.2; Differentiability of functions, Differentiation by first principle rule.
	HM-68	Exercise - 9.2; General formulae of differentiation, Exercise - 9.3; Derivative of products of functions. Derivative of quotients of functions.
	HM-69	Exercise - 9.4; Differentiation of conjugate functions., La Hôspital's Rule (Admission Special).
	HM-70	Exercise - 9.4; Concept of inverse trigonometric functions, Differentiation using logarithms related
	HM-71	Exercise - 9.5; Derivative of undefined functions, Differentiation of parametric equations; Differentiation of functions with respect to functions, Exercise.
	HM-72	Exercise - 9.6; Periodic differentiation, nth derivative, Proof of periodic differentiation (trigonometry related).
	HM-73	Exercise - 9.6; Proof with periodic differentiation (residue), Exercise - 9.7; Physical applications.
	HM-74	Exercise - 9.7; Geometric applications.
	HM-75	Exercise - 9.8; Increasing, decreasing, maximum and minimum.
	HM-76	Exercise - 9.8; Mathematical problems of maximum and minimum.
Chapter-10 Integration	HM-77	Exercise - 10.1; Basic concept of integration, some properties of integration, Use of the general integral formula
	HM-78	Exercise - 10.1; Integration by simplification, Exercise - 10.2; Substitution method, $\int f(x).f'(x)dx$, $\int f(g(x))\ g'(x)dx$,
	HM-79	Exercise – 10.2; Of shape $\int \sin Ax \cos Bx\, dx$, $\int \sin Ax \sin Bx\, dx$, $\int \cos Ax \cos Bx\, dx$, $\int \sin^m x \cos^n x\ dx$,, $\int \frac{dx}{1\pm\sin ax}$, $\int \frac{dx}{1\pm\cos ax}$., $\int (ax+b)^n dx$, $\int sin^n x\, dx$, $\int cos^n x\, dx$.
	HM-80	Exercise – 10.3; Ideal integral, of shape $\int \frac{f'(x)}{f(x)}dx = \ln\lvert f(x)\rvert + c$, $\int \frac{f'(x)}{\sqrt{f(x)}} = 2\sqrt{f(x)} + c$.
	HM-81	Exercise - 10.3; Fractions and irrational shape of quadratic expressions, in case of $\int \frac{ax+b}{cx+d}dx$, $\int \frac{ax+b}{\sqrt{cx+d}}dx$, $\int \frac{ax+b}{(cx+d)^n}dx$ shape, $a^2 + x^2$, $a^2 - x^2$, $x^2 - a^2$ related, of shape $\int \frac{dx}{a\cos^2 x+b\sin^2 x+c}$.
	HM-82	Exercise - 10.3; Of shape $\int \sqrt{\frac{a+x}{a-x}}dx$, $\int \frac{\sqrt{ax+b}}{\sqrt{cx+d}}dx$, $\int \frac{a\cos x+b\sin x}{c\cos x+d\sin x}dx$;, $\int \frac{dx}{a+be^{mx}}$, $\int \frac{dx}{a+be^{-mx}}$ and $\int \frac{dx}{ae^{mx}+be^{-mx}}$, $\int \frac{e^{mx}+e^{nx}}{e^{px}+e^{qx}}dx$ where, $m-n=p-q$, $\int \frac{dx}{g(x)\sqrt{\phi(x)}}$; where $g(x)$ and $\phi(x)$ are polynomial function.
	HM-83	Exercise - 10.4; Integration by parts, use of LIATE, (Determining integration by parts), $\int \sec^n x\ dx$;
	HM-84	Exercise - 10.4; $\int e^{ax}\{a f(x) + f'(x)\}dx$, Exercise - 10.5; Integration using partial fractions, $\frac{x}{(x-1)(x-2)}$, $\frac{x}{(x-1)^2(x-2)}$, $\frac{x}{(x-1)(x^2+1)}$, $\frac{x^3}{(x-1)(x-2)(x-3)}$.
	HM-85	Exercise - 10.6; Concept of definite integral, properties of definite integral, Fundamental theorem of calculus, use of fundamental theorem of calculus, substitution method in case of definite integral, problems related to use of substitution method in case of definite integral.

	HM-86	Exercise - 10.6; Special properties of definite integral, area with net sign, definite integration of even and odd functions, integration of functions with absolute value, integration by graph shifting.
	HM-87	Exercise-10.7; Area determination by integration, Area of the region bounded by the line y=f(x) and the x-axis within a certain limit, Area of the region bounded by the line x=f(y) and the y-axis within a certain limit, Area of the region bounded by two curves and two straight lines parallel to the y-axis (area determination with respect to the x-axis), Area of the region bounded by two curves and two straight lines parallel to the x-axis (area determination with respect to the y-axis), Difference between integration and area.
	HM-88	Exercise - 10.7; Symmetry, Area determination related problems.

Botany		
Chapter	**Lecture**	**Lecture-based discussion topics**
Chapter 1 Cell and Its structure	B-01	Cell, Endosymbiosis, Characteristics of the Cell, Cytology, Cell Theory, Types of Cell, Plant Cell, Cell Wall
	B-02	Protoplast, Cell Membrane, Cytoplasm and organelles, Ribosome
	B-03	Endoplasmic Reticulum, Golgi Body, Lysosome, Mitochondria
	B-04	Plastid, Centriole, Cytoskeleton, Peroxisome, Glyoxisome, Cell Vacuole
	B-05	Nucleus, Ergastic Substances of the Cell, Chromosome, Nucleic Acid.
	B-06	DNA, Replication.
	B-07	RNA, Transcription, Reverse Transcription
	B-08	Translation, Central Dogma of Biology, Gene, Genetic Code
Chapter-2 Cell Division	B-09	Amitosis, Cell Cycle: Controllers of Cell Cycle, Interphase: G_1 Phase, S Phase, G_2 Phase.
	B-10	M-phase (Prophase, Prometaphase, Metaphase, Anaphase, Telophase) *Uncontrolled Mitosis,* Cell Death
	B-11	Importance of Mitosis, Meiosis: Meiosis 1: Prophase-1, Metaphase-1, Anaphase-1, Telophase-1, Interkinesis-1
	B-12	Meiosis-2: Prophase-2, Metaphase-2, Anaphase-2, Telophase-2, Cytokinesis-2, Characteristics of Meiosis, Importance of Meiosis, Crossing Over.
Chapter-3 Cell Chemistry	B-13	Carbohydrate: Characteristics of Carbohydrate, Types of Carbohydrate: Monosaccharide (Triose, Tetrose, Pentose).
	B-14	Monosaccharide (Hexose, Heptose), Disaccharide
	B-15	Oligosaccharide, Polysaccharide, Functions of Carbohydrate
	B-16	Amino Acid: Types of Amino Acid, Protein: Types of Protein
	B-17	Lipid: Structure of Lipid, Types of Lipids, Role of lipid in living body
	B-18	Enzyme: Characteristics of enzyme, mechanism of action of enzyme, theories regarding mechanism of action of enzyme. Classification of enzyme, regulators of enzyme, Uses of enzyme
Chapter-4 Microorganisms	B-19	virus: contribution of scientists in the discovery of virus, structure of virus, classification of virus, parasitism of virus, emerging virus, subviral entities, T_2 bacteriophage, COVID-19 Corona virus
	B-20	Lifecycle of virus, importance of virus, viral diseases at a glance, description of some viral diseases
	B-21	Bacteria: Characteristics of bacteria: distribution and habitat of bacteria: types of bacteria, structure of an ideal bacterium
	B-22	Reproduction of bacteria, importance of bacteria, some bacterial diseases
	B-23	Malaria: Infection of malaria, Prevention and control of Malaria, Lifecycle of malarial parasite in human body
	B-24	Lifecycle of Malarial parasite in mosquito, Alternation of generation of malarial parasite
Chapter-5 Algae and fungi	B-25	Bentham Hooker classification, Algae (Characteristics, Physical structure, Cellular structure)
	B-26	Reproduction of algae (Vegetative reproduction, Asexual reproduction, sexual reproduction), *Ulothrix* (habitat, Physical structure, reproduction), Economic importance of algae
	B-27	Fungi (Characteristics, Physical structure, Cellular Structure), Reproduction of fungi (Vegetative reproduction, asexual reproduction, sexual reproduction), importance of fungi (advantages and disadvantages)
	B-28	*Agaricus* (Habitat, Physical structure), Economic importance of *Agaricus*, fungal diseases, Lichen (Habitat, Characteristics, Structure, Classification), Importance of Lichen.
Chapter-6 Bryophyta and Pteridophyta	B-29	Bryophyta: Introduction to Bryophyta, Characteristics of Bryophyta, *Riccia*: Characteristics of *Riccia*, External Structure of *Riccia*, Internal structure of *Riccia*: Reproduction and alternation of generation of *Riccia*
	B-30	Pteriodophyta: Characteristics of Pteridophyta, *Pteris*: Physical structure of *Pteris*, Internal Structure, Reproduction of *Pteris*, Alternation of generation in *Pteris*, Economic importance of *Pteris.*
Chapter-7 Gymnosperms and Angiosperms	B-31	Gymnosperms (Introduction, characteristics), *Cycas* (Characteristics, Structure, Reproduction)
	B-32	Angiosperms (Introduction, characteristics), Differences between Gymnosperm and angiosperm, Introduction to angiosperm families, Characteristics, Root, Stem, Leaf
	B-33	Inflorescence, Aestivation, Placentation, Fruits, Floral Formula, Floral Diagram
	B-34	Poaceae Family, Malvaceae Family, Differences between Poaceae and Malvaceae family, Differences between Monocot plant and dicot plant

Zoology		
Chapter	**Lecture**	**Lecture-based discussion topics**
Chapter-1 Animal Diversity and Classification	Z-01	Animal Diversity: types of animal diversity, classification of animal kingdom, Basis of animal classification (Basis of animal classification (Size to embryonic layer)
	Z-02	Symmetrey to notocord, Nomenclature of animals, principles of nomenclature of animals, classification of animal kingdom, major phyla of animal kingdom: Non-chordate.
	Z-03	Porifera, Cnidaria, Platyheminthes, Nematoda.
	Z-04	Mollusca, Annelida, Arthropoda, Echinodermata.

	Z-05	Chordata: characteristics of various sub-phylum and classes of chordata, classification of vertebrates (cyclostomata)
	Z-06	Classification of vertebrates (Gnathostomata)
Chapter-2 Animal Identity	Z-07	Hydra, External structure of Hydra, Internal structure of Hydra, Cells of body wall of Hydra, Cells of Epidermis, Structure of ideal cnidocyte, Types of nematocyst, Mechanism of Discharge of nematocyst-thread
	Z-08	Cells of gastrodermis, Mesoglea, Coelenteron, Ingestion and digestion of food of Hydra, Locomotion of Hydra, Reproduction of Hydra, Regeneration of Hydra, Division of Labor of Hydra, Symbiosis
	Z-09	Grasshopper, External structure of grasshopper, Tagmata of Grasshopper, Mouth parts of grasshopper
	Z-10	Digestive system of grasshopper (Alimentary Canal, Digestive Glands), Ingestion and Digestion of food
	Z-11	Blood circulatory system of grasshopper, respiratory system, excretory system
	Z-12	Sensory organs of grasshopper, Compound eye of grasshopper, Mechanism of vision, process of reproduction, metamorphosis, role of hormone in metamorphosis
	Z-13	Rohu fish, External Structure, Scales, Blood Circulatory system of Rohu fish, Blood, Heart, Blood Vessels (Arterial system of Rohu fish)
	Z-14	Venous system of Rohu fish, Respiratory system, Structure of gills, mechanism of respiration, air bladder, Reproduction and lifecycle of Rohu fish
Chapter-3 Human Physiology: Digestion and Absorption	Z-15	Digestion: Types of digestion, Digestive system, Oral Cavity, Digestion of food in mouth, Dental formula, Pharynx, Esophagus
	Z-16	Stomach, Digestion of food in stomach, Small Intestine, Digestion of food in small intestine, Large intestine
	Z-17	Digestive glands: salivary glands, liver, pancreas, gastric glands, intestinal glands, Role of nervous system and hormones in digestion
	Z-18	Absorption of digested food: components of food and their absorption, fate of absorbed nutrientts, Obesity
Chapter-4 Human Physiology: Blood and Circulation	Z-19	Blood, Components of blood, Plasma, Blood Corpuscle, Red Blood Corpuscle
	Z-20	White Blood Corpuscle, Types of White Blood Corpuscle, Platelets
	Z-21	Mechanism of blood clotting, Lymph, Lymphatic System, Blood Vessel, Types of blood vessels
	Z-22	Heart (Location, Shape and size, Covering, Wall), Structure of cardiac muscle, Chambers of the heart, Valves of the heart, Circulation of blood through the heart
	Z-23	Heartbeat-Cardiac Cycle, Myogenic control of heartbeat and transmission of impulse
	Z-24	Blood Pressure and baroreceptor, Blood Circulation in humans (Systemic, Pulmonary, Coronary, Portal)
	Z-25	Cardiac Diseases, Chest Pain or Angina, Heart Attack, Heart Failure
	Z-26	Basic idea about treatment of cardiac disease, artifical pacemaker, Open heart surgery, Coronary Bypass surgery
Chapter-5 Human Physiology: Respiration and Breathing	Z-27	Respiration, Phases of respiration (Internal respiration and external respiration), Differences between internal and external respiration, Parts of the respiratory system
	Z-28	Lungs, Functions of the respiratory system, Breathing: inspiration and expiration, Gaseous exchange
	Z-29	Control of inspiration and expiration, Diseases of respiratory system, Artificial respiration
Chapter 6 Human Physiology: Waste and Excretion	Z-30	Various types of waste products in humans, excretory system of humans, Structure and function of kidney
	Z-31	Ultrastructure of kidney-Nephron, Functions of nephron, physiology of excretion (production of nitrogenous waste and formation of urine), Urine
	Z-32	Role of kidney in excretion and osmoregulation, kidney failure, dialysis, kidney transplant, hormonal action

