

DYPRAIT-ET 2021 Syllabus

1. Physics:

Module	Content
1. Physical Quantities and Measurements	Physics, technology and society, SI units, Fundamental and derived units. Least count, accuracy and precision of measuring instruments, Errors in measurement, Dimensions of Physical quantities, dimensional analysis and its applications.
2. Kinematics	Frame of reference. Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity Uniformly accelerated motion, velocity-time, position-time graphs, and relations for uniformly accelerated motion. Scalars and Vectors, Vector addition and Subtraction, Zero Vector, Scalar and Vector products, Unit Vector, Resolution of a Vector. Relative Velocity, Motion in a plane. Projectile Motion, Uniform Circular Motion.
3. Laws of Motion and Friction	Force and Inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion; Impulse; Newton's Third Law of motion. Law of conservation of linear momentum and its applications, Equilibrium of concurrent forces. Static and Kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: Centripetal force and its applications. Origin and nature of frictional forces, Laws of static friction, Laws of kinetic friction, Pressure due to fluid column, Pascal's Law and its applications, Effect of gravity on fluid pressure, Viscosity, Streamline flow, Turbulent flow, Viscous force, Newton's formula, Stokes' law, Equation for terminal velocity, Raynold's number, Bernoulli's principle and its applications.
4. Work, Energy and Power	Work done by a constant force and variable force; kinetic energy, work-energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces; conservation of mechanical energy (kinetic and potential energies); non-conservative forces; motion in a vertical circle, elastic and inelastic collisions in one and two dimensions.
5. Longitudinal Waves and Thermal Properties of Matter	Sound Waves: Waves and oscillations, Progressive waves, Characteristics of transverse waves, Characteristics of longitudinal waves, Sound as longitudinal wave motion, Newton's formula for velocity of sound, Laplace's correction.

	<p>Thermal properties of matter: Temperature and heat, Measurement of temperature, Ideal-gas equation and absolute temperature, Thermal expansion, Specific heat capacity, Calorimetry, Change of state, Latent heat, Heat transfer.</p>
<p>6. Basics of Optics</p>	<p>Refraction of monochromatic light, Snell's law, Total internal reflection, Critical angle, Optical fibre, Dispersion of light, Prism formula, Angular dispersion and dispersive power, Rainbow, Scattering of light, Blue colour of sky, Colour of sun at sunrise and sunset. Elementary idea of Raman effect. Reflection of light by spherical mirrors, Refraction at single curved surface, Lens maker's equation, Combination of thin lenses in contact, Concept of conjugate foci, Correction of eye defects, Magnifying power of simple microscope, Magnifying power of compound microscope, Magnifying power of telescope, Reflecting telescope - schematic diagram with explanation.</p>
<p>7. Electrostatics and Magnetism I</p>	<p>Electrostatics: Frictional electricity, Charges and their conservation, Coulomb's law and dielectric constant, Forces between multiple electric charges, Superposition principle of forces, Continuous distribution of charges, Concept of charge density, Electric field intensity, Potential energy, Electric potential due to point charge, Relation between electric field intensity and potential, Potential difference, Volt and electron volt, Electric dipole and dipole moment, Electric lines of force. Equipotential surfaces, P.E. of single charge and system of charges.</p> <p>Current Electricity: Ohm's law, Resistance, Specific resistance, Temperature dependence of resistance, Colour code of carbon resistor, Series and parallel combination of resistors, E.M.F. and internal resistance of cell, Work done by electric current, Power in electric circuit, Cells in series and in parallel, Elementary idea of secondary cells.</p> <p>Magnetic effect of electric current: Oersted's experiment, Biot Savart's law, Right hand rule, Magnetic induction at the centre of circular coil carrying current, Magnetic induction at a point along the axis of a coil carrying current, Fleming's left hand rule, Force between two infinitely long current carrying parallel conductors, Definition of Ampere, Force acting on a conductor carrying current in magnetic field, Torque on a current loop in magnetic field.</p> <p>Magnetism: Origin of magnetism due to moving charges, Equivalence between magnetic dipole and circular coil</p>

	<p>carrying current, Definition of magnetic dipole moment and its unit, Torque acting on a magnet in uniform magnetic induction, Bar magnet as an equivalent solenoid, Magnetic field lines, Magnetic induction due to bar magnet at a point along the axis and at a point along equator, Earth's magnetic field and magnetic elements, Electromagnets and factors affecting their strength.</p> <p>Electromagnetic waves: Electromagnetic waves and their characteristics, Transverse nature of electromagnetic waves, Electromagnetic spectrum, Space communication, Propagation of electromagnetic waves in atmosphere.</p>
8. Electrons and photons and Dual Nature of light	<p>Photoelectric effect, Hertz and Lenard's observations, Einstein's equation, Particle nature of light.</p>
9. Circular motion and Rotational motion	<p>Angular displacement, Angular velocity and angular acceleration, Relation between linear velocity and angular velocity, Uniform circular motion, Radial acceleration, Centripetal and centrifugal forces, Banking of roads, Vertical circular motion due to earth's gravitation, Equation for velocity and energy at different positions of vertical circular motion. Kinematical equations for circular motion in analogy with linear motion. Definition of M.I., K.E. of rotating body, Rolling motion, Physical significance of M.I., Radius of gyration, Torque, Principle of parallel and perpendicular axes, M.I. of some regular shaped bodies about specific axes, Angular momentum and its conservation.</p>
10. Gravitation	<p>Newton's law of gravitation, Projection of satellite, Periodic time, Statement of Kepler's laws of motion, Binding energy and escape velocity of a satellite, Weightlessness condition in orbit, Variation of 'g' due to altitude, latitude, depth and motion, Communication satellite and its uses.</p>
11. Wave motion and Stationary waves	<p>Simple harmonic progressive waves, Reflection of transverse and longitudinal waves, Change of phase, Superposition of waves, Formation of beats, Doppler effect in sound. Study of vibrations in a finite medium, Formation of stationary waves on string, Study of vibrations of air columns, Free and Forced vibrations, Resonance</p>
12. Wave Optics	<p>Wave theory of light, Huygens' Principle, Construction of plane and spherical wave front, Wave front and wave normal, Reflection at plane surface, Refraction at plane surface, Polarisation, Polaroids, Plane polarised light, Brewster's law, Doppler effect in light. Interference of light, Conditions for producing steady interference pattern, Young's experiment, Analytical treatment of</p>

	interference bands, Measurement of wavelength by biprism experiment, Diffraction due to single slit, Rayleigh's criterion, Resolving power of a microscope and telescope, Difference between interference and diffraction.
13. Elasticity and Surface tension	<p>General explanation of elastic property, Plasticity, Deformation, Definition of stress and strain, Hooke's law, Poisson's ratio, Elastic energy, Elastic constants and their relation, Determination of 'Y', Behaviour of metal wire under increasing load, Applications of elastic behaviour of materials.</p> <p>Surface tension on the basis of molecular theory, Surface energy, Surface tension, Angle of contact, Capillarity and capillary action, Effect of impurity and temperature on surface tension.</p>
14. Electricity and Magnetism II	<p>Electrostatics: Gauss' theorem proof and applications, Mechanical force on unit area of a charged conductor, Energy density of a medium, Dielectrics and electric polarisation, Concept of condenser, Capacity of parallel plate condenser, Effect of dielectric on capacity, Energy of charged condenser, Condensers in series and parallel, van-de- Graaff generator.</p> <p>Current electricity: Kirchhoff's law, Wheatstone's bridge, Meter bridge, Potentiometer. Magnetic effects of electric current: Ampere's law and its applications, Moving coil galvanometer, Ammeter, Voltmeter, Sensitivity of moving coil galvanometer, Cyclotron.</p> <p>Magnetism: Circular current loop as a magnetic dipole, Magnetic dipole moment of revolving electron, Magnetisation and magnetic intensity, Diamagnetism, Paramagnetism, Ferromagnetism on the basis of domain theory, Curie temperature. Electromagnetic inductions: Laws of electromagnetic induction, proof of, $\epsilon = - d\Phi/dt$ Eddy currents, Self induction and mutual induction, Need for displacement current, Transformer, Coil rotating in uniform magnetic induction, Alternating currents, Reactance and impedance, LC oscillations (qualitative treatment only) Power in a.c circuit with resistance, inductance and capacitance, Resonant circuit, Wattless current, AC generator.</p>
15. Atoms, Molecules, Nuclei and Semiconductors	<p>Atoms, Molecules and Nuclei: Alpha particle scattering experiment, Rutherford's model of atom. Bohr's model, Hydrogen spectrum, Composition and size of nucleus, Radioactivity, Decay law, massenergy relation, mass defect, B.E. per nucleon and its variation with mass number, Nuclear fission and fusion, de Broglie hypothesis, Matter waves – wave</p>

	<p>nature of particles, Wavelength of an electron, Davisson and Germer experiment, Continuous and characteristics X rays.</p> <p>Semiconductors: Energy bands in solids, Intrinsic and extrinsic semiconductors, P-type and Ntype semiconductor, P-N junction diode, I-V characteristics in forward and reverse bias, Rectifiers, Zener diode as a voltage regulator, Photodiode, Solar cell, I-V characteristics of LED, Transistor action and its characteristics, Transistor as an amplifier (CE mode), Transistor as a switch, Oscillators and Logic gates (OR,AND, NOT, NAND, NOR)</p>
16. Kinetic theory of gases and Radiation	<p>Concept of an ideal gas, Assumptions of kinetic theory, Mean free path, Derivation or pressure of a gas, Degrees of freedom, Derivation of Boyle's law, Thermodynamics-Thermal equilibrium and definition of temperature, 1st law of thermodynamics, 2nd law of thermodynamics, Heat engines and refrigerators, Qualitative idea of black body radiation, Wein's displacement law, Green house effect, Stefan's law, Maxwell distribution, Law of equipartition of energy and application to Specific heat capacities of gases.</p>

2. Chemistry:

Module	Contents
1. Some Basic Concepts of Chemistry	<p>General Introduction: Important and scope of chemistry Laws of chemical combination, Dalton's atomic theory: concept of elements, atoms and molecules Atomic and molecular masses Mole concept and molar mass; percentage composition and empirical and molecular formula; chemical reactions, stoichiometry and calculations based on stoichiometry</p>
2. Structure of Atom	<p>Atomic number, isotopes and isobars Concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbital, quantum numbers, shapes of s,p and d orbitals, rules for filling electrons in orbitals- Aufbau principle, Pauli exclusion principles and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals</p>
3. Classification of Elements and Periodicity in Properties	<p>Modern periodic law and long form of periodic table, periodic trends in properties of elements atomic radii, ionic radii, ionization enthalpy, electron gain enthalpy, electronegativity, valence</p>

<p>4. Chemical Bonding and Molecular Structure</p>	<p>Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, valence bond theory, resonance, geometry of molecules, VSEPR theory Concept of hybridization involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only) Hydrogen bond</p>
<p>5. States of Matter: Gases and Liquids</p>	<p>Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws of elucidating the concept of the molecule, Boyle's law, Charles's law, Gay Lussac's law, Avogadro's law, ideal behavior of gases, empirical derivation of gas equation. Avogadro number, ideal gas equation Kinetic energy and molecular speeds (elementary idea), deviation from ideal behavior, liquefaction of gases, critical temperature Liquid State- Vapor pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations)</p>
<p>6. Chemical Thermodynamics</p>	<p>First law of thermodynamics-internal energy and enthalpy, heat capacity and specific heat, measurement of U and H, Hess's law of constant heat summation, enthalpy of : bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution Introduction of entropy as state function, Second law of thermodynamics, Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium and spontaneity Third law of thermodynamics- Brief introduction</p>
<p>7. Equilibrium</p>	<p>Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of chemical equilibrium, equilibrium constant, factors affecting equilibrium- Le Chatelier's principle; ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of polybasic acids, acid strength, concept of pH, Hydrolysis of salts (elementary idea)., buffer solutions, Henderson equation, solubility product, common ion effect (with illustrative examples)</p>
<p>8. Hydrogen</p>	<p>Occurrence, isotopes, preparation, properties and uses of hydrogen; hydrides, ionic, covalent and interstitial; physical and chemical properties of water, heavy water; hydrogen peroxide-preparation, reactions, uses and structure;</p>
<p>9. s-Block Elements (Alkali and Alkaline earth metals)</p>	<p>Group I and group 2 elements: General introduction, electronic configuration, occurrence, anomalous properties of the first element of</p>

	<p>each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens; uses Preparation and Properties of Some important Compounds:, Sodium carbonate, sodium chloride, sodium hydroxide and sodium hydrogen carbonate, biological importance of sodium and potassium Industrial use of lime and limestone, biological importance of Mg and Ca</p>
10. Some p-Block Elements	<p>General Introduction to p-Block Elements Group 13 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group; Boron, some important compounds: borax, boric acids, boron hydrides. Aluminium: uses, reactions with acids and alkalis General 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behavior of first element. Carbon, allotropic forms, physical and chemical properties: uses of some important compounds: oxides Important compounds of silicon and a few uses: silicon tetrachloride, silicones, silicates and zeolites, their uses</p>
11. Basic principles and techniques in organic chemistry	<p>General introduction, methods of purification qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions; electrophiles and nucleophiles, types of organic reactions</p>
12. Hydrocarbons	<p>Alkanes- Nomenclature, isomerism, conformations (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis Alkanes-Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation: chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), 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</p>

	<p>reaction of- hydrogen, halogens, hydrogen halides and water.</p> <p>Aromatic hydrocarbons- Introduction, IUPAC nomenclature; Benzene; resonance, aromaticity; chemical properties: mechanism of electrophilic substitution-Nitration sulphonation, halogenation, 50 Friedel-Craft's alkylation and acylation; directive influence of functional group in mono-substituted benzene; carcinogenicity and toxicity</p>
13. Environmental Chemistry	<p>Environmental pollution: Air, water and soil pollution, chemical reactions in atmosphere, smogs, major atmospheric pollutants; acid rain ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming-pollution due to industrial wastes; green chemistry as an alternative tool for reducing pollution, strategy for control of environmental pollution</p>
14. Solid State	<p>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, electrical and magnetic properties, Band theory of metals, conductors, semiconductors and insulators.</p>
15. Solutions and Colligative Properties	<p>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 boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties abnormal molecular mass. Van Hoff factor.</p>
16. Electrochemistry	<p>Redox reactions: Concept of oxidation and oxidation and reduction, redox reactions oxidation number, balancing redox reactions in terms of loss and gain of electron and change in oxidation numbers</p> <p>Conductance in electrolytic solutions, specific and molar conductivity variation of conductivity with concentration, Kohlrausch's Law, electrolysis and Laws of electrolysis (elementary idea), dry cell-electrolytic cells and Galvanic cells; lead accumulator, EMF of a cell, standard electrode potential, Relation between Gibbs energy change and EMF of a cell, fuel cells; corrosion</p>
17. Chemical Kinetics	<p>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</p>

	half-life (only for zero and first order reactions); concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenius equation
18. General Principles and Processes of Isolation of Elements	Principles and methods of extraction- concentration, oxidation, reduction electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron
19. p- Block Elements	<p>Group 15 elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; preparation and properties of ammonia and nitric acid, oxides of nitrogen (structure only); Phosphorous- allotropic forms; compounds of phosphorous: preparation and properties of phosphine, halides (PCl₃, PCl₅) and oxoacids (elementary idea only)</p> <p>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, preparation, properties and uses of sulphur dioxide; sulphuric acid: industrial process of manufacture, properties and uses, oxoacids of sulphur (structures only)</p> <p>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, inter-halogen compounds oxoacids of halogens (structures only)</p> <p>Group 18 elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses</p>
20. d and f Block Elements	<p>General introduction, electronic configuration, characteristics of transition metals, general trends in properties of the first row transition metals- metallic character, ionization enthalpy, oxidation states, ionic radii, color, catalytic property, magnetic properties, interstitial compounds, alloy formation. Preparation and properties of K₂Cr₂O₇ and KMnO₄</p> <p>Lanthanoids- electronic configuration, oxidation states, chemical reactivity, and lanthanoid contraction and its consequences</p> <p>Actinoids: Electronic configuration, oxidation states and comparison with lanthanoids</p>
21. Coordination Compounds	Coordination compounds: Introduction, ligands, coordination number, color, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds, isomerism (structural and stereo) bonding, Werner's theory VBT,CFT;

	importance of coordination compounds (in qualitative analysis, biological systems)
22. Organic Compounds Containing Halogens	<p>Haloalkanes: Nomenclature, nature of C –X bond, physical and chemical properties, mechanism of substitution reactions. Optical rotation</p> <p>Haloarenes: Nature of C-X bond, substitution reactions (directive influence of halogen for mono-substituted compounds only)</p> <p>Uses and environment effects of – dichloromethane, trichloromethane, tetra-chloromethane, iodoform, freons, DDT.</p>
23. Organic Compounds Containing Oxygen	<p>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</p> <p>Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols</p> <p>Ethers: Nomenclature, methods of preparation, physical and chemical properties use</p> <p>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</p> <p>Carboxylic Acids: Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses</p>
24. Organic Compounds Containing Nitrogen	<p>Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary secondary and tertiary amines</p> <p>Cyanides and Isocyanides- will be mentioned at relevant places</p> <p>Diazonium salts: Preparation, chemical reactions and importance in synthetic organic chemistry</p>
25. Biomolecules	<p>Carbohydrates- Classification (aldoses and ketoses), monosaccharide (glucose and fructose), D.L. configuration, oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen): importance</p> <p>Proteins- Elementary idea of – amino acids, peptide bond, polypeptides, proteins, primary structure, secondary structure, tertiary structure and quaternary structure (qualitative idea only), denaturation of proteins; enzymes</p> <p>Hormones- Elementary idea (excluding structure)</p> <p>Vitamins- Classification and function. Nucleic Acids: DNA and RNA</p>

26. Polymers	Classification- Natural and synthetic, methods of polymerization (addition and condensation), copolymerization. Some important polymers: natural and synthetic like polyesters, bakelite; rubber, Biodegradable and non-biodegradable polymers
27. Chemistry in Everyday Life	Chemicals in medicines- analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines Chemicals in food- preservatives, artificial sweetening agents, elementary idea of antioxidants Cleansing agents- soaps and detergents, cleansing action.

3. Mathematics:

Module	Content
1. Sets, Relations, and Functions	Sets and their representation, Union, intersection, and complement of sets and their algebraic properties, Powerset, Relation, Types of relations, equivalence relations, Functions; one-one, into and onto functions, the composition of functions.
2. Complex Numbers and Quadratic Equations	Complex numbers as ordered pairs of reals, Representation of complex numbers in the form $(a+ib)$ and their representation in a plane, Argand diagram, Algebra of complex numbers, modulus and argument (or amplitude) of a complex number, square root of a complex number, Triangle inequality, Quadratic equations in real and complex number system and their solutions, The relation between roots and coefficients, nature of roots, the formation of quadratic equations with given roots.
3. Matrices and Determinants	Determinants: Properties of determinants, evaluation of determinants, the area of triangles using determinants. Matrices: Algebra of matrices, types of matrices, and matrices of order two and three, Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test of consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices.
4. Permutations and Combinations	The fundamental principle of counting, Permutation as an arrangement and combination as selection, The meaning of ${}^n P_r$ and ${}^n C_r$ and Simple applications
5. Mathematical Induction	The principle of Mathematical Induction and its simple applications.
6. Binomial Theorem	Binomial theorem for a positive integral index, General term and middle term, Properties of Binomial coefficients and simple applications.

<p>7. Sequence and Series</p>	<p>Arithmetic and Geometric progressions, insertion of arithmetic, Geometric means between two given numbers, The relation between A.M. and G.M., Sum up to n terms of special series: Sn, Sn2, Sn3, Arithmetic Geometric progression.</p>
<p>8. Limit, Continuity and Differentiability</p>	<p>Real-valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse functions, Graphs of simple functions, Limits, continuity, and differentiability, Differentiation of the sum, difference, product, and quotient of two functions, Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order up to two, Rolle's and Lagrange's Mean Value Theorems, Applications of derivatives: Rate of change of quantities, monotonic increasing and decreasing functions, Maxima, and minima of functions of one variable, tangents, and normals.</p>
<p>9. Integral Calculus</p>	<p>Integral as an antiderivative, Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions, Integration by substitution, by parts, and by partial fractions, Integration using trigonometric identities, Integral as limit of a sum.</p> <p>Evaluation of simple integrals: $\int \frac{dx}{x^2+a^2}$, $\int \frac{dx}{\sqrt{x^2+a^2}}$, $\int \sqrt{a^2 \pm x^2} dx$, $\int \frac{dx}{a^2-x^2}$, $\int \frac{dx}{\sqrt{a^2-x^2}}$, $\int \frac{dx}{x^2-a^2}$, $\int \frac{dx}{\sqrt{x^2-a^2}}$, $\int \sqrt{x^2-a^2} dx$, $\int \frac{dx}{ax^2+bx+c}$, $\int \frac{dx}{\sqrt{ax^2+bx+c}}$</p> <p>$\int \frac{(px+q)dx}{ax^2+bx+c}$, $\int \frac{(px+q)dx}{\sqrt{ax^2+bx+c}}$</p> <p>Fundamental Theorem of Calculus, Properties of definite integrals, evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form.</p>
<p>10. Differential Equations</p>	<p>Ordinary differential equations, their order, and degree, Formation of differential equations, The solution of differential equations by the method of separation of variables, The solution of homogeneous and linear differential equations of the type:</p> $\frac{dy}{dx} + P(x)y = Q(x)$
<p>11. Coordinate Geometry</p>	<p>Cartesian system of rectangular coordinates in a plane, distance formula, section formula, locus and its equation, translation of axes, the slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes.</p> <p>Straight lines: Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, Distance of a point from a line, equations of internal and external</p>

	<p>bisectors of angles between two lines, coordinates of the centroid, orthocentre, and circumcentre of a triangle, equation of the family of lines passing through the point of intersection of two lines, Circles, Conic sections: Standard form of equation of a circle, general form of the equation of a circle, its radius and centre, equation of a circle when the endpoints of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to a circle, equation of the tangent, Sections of cones, equations of conic sections (parabola, ellipse, and hyperbola) in standard forms, condition for $y = mx + c$ to be a tangent and point (s) of tangency.</p>
12. 3D Geometry	<p>Coordinates of a point in space, the distance between two points, Section formula, direction ratios and direction cosines, the angle between two intersecting lines, Skew lines, the shortest distance between them and its equation, Equations of a line and a plane in different forms, the intersection of a line and a plane, coplanar lines,</p>
13. Vector Algebra	<p>Scalars and Vectors. Addition, subtraction, multiplication and division of vectors, Vector's Components in 2D and 3D space, Scalar products and vector products, triple product.</p>
14. Statistics and Probability	<p>Measures of Dispersion: Calculation of mean, mode, median, variance, standard deviation, and mean deviation of ungrouped and grouped data.</p> <p>Probability: Probability of events, multiplication theorems, addition theorems, Baye's theorem, Bernoulli trials, Binomial distribution and probability distribution</p>
15. Trigonometry	<p>Identities of Trigonometry and Trigonometric equations, Functions of Trigonometry, Properties of Inverse trigonometric functions, Problems on Heights and Distances.</p>
16. Mathematical Logic	<p>Statements and logical operations: or, and, implied by, implies, only if and if, Understanding of contradiction, tautology, contrapositive and converse.</p>
17. Linear Programming	<p>Converting business problems into mathematical models, working rule to formulate LPP, Terminologies related to the solution of LPP, solution of LPP by graphical method, special cases of LPP.</p>