ANNEXURE I

SYLLABUS FOR THE ENTRANCE EXAMINATIONS, 2006

(See Clause 9.5.1)

MATHEMATICS

UNIT I: ALGEBRA

Sets, Relations and Functions

Sets and their Representations: Finite and Infinite sets; Empty set; Equal sets; Subsets; Power set; Universal set; Venn Diagrams; Complement of a set; Operations on Sets (Union, Intersection and Difference of Set); Applications of sets: Ordered Pairs, Cartesian Product of Two sets; Relations: Domain, Co-domain and Range: Functions: into, on to, one - one in to, one-one on to Functions; Constant Function; Identity Function; composition of Functions; Invertible Functions; Binary Operations.

Complex Numbers

Complex Numbers in the form $a+ib$; Real and Imaginary Parts of a complex Number; Complex Conjugate, Argand Diagram, Representation of Complex Number as a point in the plane; Modulus and Argument of a Complex Number; Algebra of Complex Numbers; Triangle Inequality; $|Z_1+Z_2|\le|Z_1|+|Z_2|$; $|Z_1.Z_2|=|Z_1||Z_2|$; Polar Representation of a Complex Number; Square Root of a Complex Number; Cube Roots of Unity.

Quadratic Equations

Solution of a Quadratic Equation in the Complex Number System by (i) Factorization (ii) Using Formula; Relation between Roots and Coefficients; Nature of Roots; Formation of Quadratic Equations with given Roots; Symmetric Functions of Roots; Equations Reducible to Quadratic Forms.

Sequences and Series

Sequence and Examples of Finite and Infinite Sequences; Arithmetic Progression (A..P): First Term, Common Difference, n^{th} Term and sum of n terms of an A.P.; Arithmetic Mean (A.M); Insertion of Arithmetic Means between any Two given Numbers; Geometric Progression (G.P): first Term, Common Ratio and nth term, Sum to n Terms and Sum of Infinite Numbers as Geometric series: Geometric Mean (G.M); Insertion of Geometric Means between any two given Numbers; Harmonic Progression (H.P); Harmonic Mean (H.M); Relationship among A.M., G.M., and H.M.; Arithmetico – Geometric Series: sum to n term and sum of Infinite Number of Terms of an Arithmetico Geometric Series; Series $\Sigma n, \Sigma n^2, \Sigma n^3$.

Logarithms, Exponential and Logarithmic Series

Meaning of logarithm of a number to a given base a, a>o, $a \neq 1$; Laws of Logarithms including change of Base; Common Logarithms (base 10); characteristic and Mantissa; Antilogarithms; Logarithmic tables; Simple Applications of Logarithms to Problems of Compound Interest; Growth and Decay (depreciation). Concept of 'e' as the sum of an Infinite series; Proof of 2<e<3; Exponential Function (e^x) as the Infinite series $1+\frac{x}{1!}+\frac{x^2}{2!}+.....$, and its graph. Logarithmic function $\log_e x$ and its graph. The Infinite series of $\log_e(1+x)$, $\log_e(1-x)$, $\log_e\left(\frac{1+x}{1-x}\right)$ and related problems.

Permutations, Combinations, Binomial Theorem and Mathematical Induction

Fundamental Principle of Counting; The Factorial Notation; Permutation as an Arrangement; Meaning of P(n, r); Combination: Meaning of C(n,r); Applications of Permutations and Combinations. Statement of Binomial Theorem; Proof of Binomial Theorem for positive integral Exponent using Principle of Mathematical Induction and also by combinatorial Method; General and Middle Terms in Binomial Expansions; Properties of Binomial Coefficients; Binomial Theorem for any Index (without proof); Application of Binomial Theorem. The Principle of Mathematical Induction, simple Applications

Matrices and Determinants

Concept of a Matrix; Types of Matrices; Equality of Matrices (only real entries may be considered): Operations of Addition, Scalar Multiplication and Multiplication of Matrices; Statement of Important Results on operations of Matrices and their Verifications by Numerical Problem only; Determinant of a Square Matrix; Minors and Cofactors; singular and non-singular Matrices; Applications of Determinants in (i) finding the Area of a Triangle (ii) solving a system of Linear Equations (Cramer's Rule); Transpose, Adjoint and Inverse of a Matrix; Consistency and Inconsistency of a system of Linear Equations; Solving

System of Linear Equations in Two or Three variables using Inverse of a Matrix (only up to 3X3 Determinants and Matrices should be considered).

Linear Inequations

Solutions of Linear Inequation in one variable and its Graphical Representation; solution of system of Linear Inequations in one variable; Graphical solutions of Linear inequations in two variables; solutions of system of Linear Inequations in two variables.

Mathematical Logic and Boolean Algebra

Statements; use of Venn Diagram in Logic; Negation Operation; Basic Logical Connectives and Compound Statements including their Negations; Truth Tables; Tautology; Duality; Algebra of Statements; Application of Logic in solving simple problems. Boolean Algebra as an Algebraic structure; Principle of Dualilty; Boolean function; conditional and Biconditional statements; Valid Arguments; Switching Circuits; Application of Boolean Algebra to switching circuits.

UNIT II : TRIGONOMETRY

10. Trigonometric functions and Inverse Trigonometric functions

Degree measures and Radian measure of positive and negative angles; relation between degree measure and radian measure, definition of trigonometric functions with the help of a unit circle, periodic functions, concept of periodicity of trigonometric functions, value of trigonometric functions of x for x = 0, $p/6$, $p/4$, $p/3$, $p/2$, π, $3p/2$, $2p$; trigonometric functions of sum and difference of numbers.

$Sin(x \pm y) = Sin\,x\,Cos\,y \pm Cos\,x\,Sin\,y$; $Cos(x \pm y) = Cos\,x\,Cos\,y \mp Sin\,x\,Sin\,y$; $Tan(x \pm y) = \dfrac{Tan\,x \pm Tan\,y}{1 \mp Tan\,x\,Tan\,y}$;

$Sin(2p \pm x) = \pm Sin\,x$, $Cos(2p \pm x) = Cos\,x$; $Cos(-x) = Cos\,x$, $Sin(-x) = -Sin\,x$; $Cos(p/2 \pm x) = \pm Sin\,x$

$Sin(p/2 \pm x) = Cos\,x$; $Cos(p \pm x) = -Cos\,x$, $Sin(p \pm x) = \pm Sin\,x$

Trigonometric functions of multiple and submultiples of numbers.

$Sin\,2x = 2\,Sin\,x\,Cos\,x$;

$Sin3x = 3Sinx - 4Sin^3x$; $Cos\,2x = Cos^2x - Sin^2x = 1 - 2\,Sin^2x = 2\,Cos^2x - 1$; $Cos\,3x = 4\,Cos^3x - 3\,Cos\,x$

$Tan3x = \dfrac{3\,Tan\,x - Tan^3x}{1 - 3Tan^2x}$; $Sin\,x + Sin\,y = 2\,Sin\left(\dfrac{x+y}{2}\right)Cos\left(\dfrac{x-y}{2}\right)$; $Cos\,x + Cos\,y = 2\,Cos\left(\dfrac{x+y}{2}\right)Cos\left(\dfrac{x-y}{2}\right)$

$Sin\,x - Sin\,y = 2\,Cos\left(\dfrac{x+y}{2}\right)Sin\left(\dfrac{x-y}{2}\right)$; $Cos\,x - Cos\,y = -2\,Sin\left(\dfrac{x+y}{2}\right)Sin\left(\dfrac{x-y}{2}\right)$

Conditional identities for the angles of a triangle, solution of trigonometric equations of the type Sin x = Sin a ; Cos x = Cos a; Tan x = Tan a and equations reducible to these forms.

Inverse Trigonometric functions:

(i) $Sin^{-1}(Sin\,x) = x$ and other similar formula (ii) $Sin^{-1}(1/x) = Cosec^{-1}\,x$ and other similar formula.

$Sin^{-1}(-x) = -Sin^{-1}x$, $Tan^{-1}(-x) = -Tan^{-1}x$; $Cosec^{-1}(-x) = -Cosec^{-1}\,x$, $Cos^{-1}(-x) = p - Cos^{-1}(x)$; $Sec^{-1}(-x) = p - Sec^{-1}(x)$, $Cot^{-1}(-x) = p - Cot^{-1}(x)$

$Sin^{-1}x + Cos^{-1}x = p/2$, $Tan^{-1}x + Cot^{-1}x = p/2$; $Cosec^{-1}(x) + Sec^{-1}(x) = p/2$; $Tan^{-1}x - Tan^{-1}y = Tan^{-1}\left(\dfrac{x-y}{1+xy}\right)$, xy > -1

$Tan^{-1}x + Tan^{-1}y = Tan^{-1}\left(\dfrac{x+y}{1-xy}\right)$; xy < 1 ; $2\,Tan^{-1}x = Sin^{-1}\left(\dfrac{2x}{1+x^2}\right) = Cos^{-1}\left(\dfrac{1-x^2}{1+x^2}\right) = Tan^{-1}\left(\dfrac{2x}{1-x^2}\right)$, $|x| < 1$

Simple problems

Graph of the following trigonometric functions;

y = Sin x ; y = Cos x ; y = Tan x ; y = a Sin x ;y = a Cos x, y = a Sin bx ; y = a Cos bx;

11. Solutions of triangles

Proof and applications of the following formula.

(1) $\dfrac{a}{Sin\,A} = \dfrac{b}{Sin\,B} = \dfrac{c}{Sin\,C}$; (2) $Cos\,A = \dfrac{b^2 + c^2 - a^2}{2bc}$ etc., (3) a = b Cos C + c Cos B etc.,

$Sin\frac{A}{2}=\sqrt{\frac{(s-c)(s-b)}{bc}}$ etc., $Cos\frac{A}{2}=\sqrt{\frac{s(s-a)}{bc}}$; $\Delta=\frac{1}{2}$ bc Sin A , etc.

Napier's analogy $Tan\frac{B-C}{2}=\frac{b-c}{b+c}\text{Cot}\frac{A}{2}$

Problems on heights and distances.

UNIT III: GEOMETRY

12. Cartesian System of Rectangular Co ordinates

Cartesian system of co ordinates in a plane, Distance formula, Centroid and incentre, Area of a triangle, condition for the collinearity of three points in a plane, Slope of line, parallel and perpendicular lines, intercepts of a line on the co ordinate axes, Locus and its equation.

13. Lines and Family of lines

Various forms of equations of a line parallel to axes, slope-intercept form, The Slope point form, Intercept form, Normal form, General form, Intersection of lines. Equation of bisectors of angle between two lines, Angles between two lines, condition for concurrency of three lines, Distance of a point from a line, Equations of family of lines through the intersection of too lines.

14. Circles and Family of circles

Standard form of the equation of a circle General form of the equation of a circle, its radius and center, Equation of the circle in the parametric form. Equation of circle when the end points of a diameter are given, Points of intersection of a line and circle with centric at origin. Condition for a line to be a tangent to the given circle. Equation of a tangent to a circle and length of the tangent.

15. Conic sections

Sections of a cone. Equations of conic sections [Parabola, Ellipse and Hyperbola] in standard form.

16. Vectors

Vectors and scalars, Magnitude and Direction of a vector, Types of vectors (Equal vectors, unit vector, Zero vector). Position vector of a point, Localized and free vectors, parallel and collinear vectors, Negative of a vector, components of a vector, Addition of vectors, multiplication of a vector by a scalar, position vector of point dividing a line segment in a given ratio, Application of vectors in geometry. Scalar product of two vectors, projection of a vector on a line, vector product of two vectors Application of dot and cross product in (1) finding work done by a force (2) finding area of a triangle and a parallelogram (3) problems of plane geometry and trigonometry (4) Vector moment of a vector about a point, Scalar triple product and its applications. Moment of a vector about a line, Coplanarity of three vectors or four points using scalar triple product, Vector triple product.

17. Three Dimensional Geometry

Coordinate axes and coordinate planes in three dimensional space, coordinate of a point in space, distance between two points, section formula, direction cosines, and direction ratios of a line joining two points, projection of the join of two points on a given line, Angle between two lines whose direction ratios are given, Cartesian and vector equation of a line through (i) a point and parallel to a given vector (ii) through two points, Collinearity of three points, coplanar and skew lines, Shortest distance between two lines, Condition for the intersection of two lines, Carterian and vector equation of a plane (i) When the normal vector and the distance of the plane from the origin is given (ii) passing though a point and perpendicular to a given vector (iii) Passing through a point and parallel to two given lines through the intersection of two other planes (iv) containing two lines (v) passing through three points, Angle between (i) two lines (ii) two planes (iii) a line and a plane, Condition of coplanarity of two lines in vector and Cartesian form, length of perpendicular of a point from a plane by both vector and Cartesian methods, vector and Cartesian equation of a sphere, its center and radius diameter form of the equation of a sphere.

UNIT IV: STATISTICS

18. Statistics and probability

Mean deviation for ungrouped data, variance for grouped an ungrouped data, standard deviation. Random experiments and sample space, Events as subset of a sample space, occurrence of an event, sure and impossible events, Exhaustive events, Algebra of events, Meaning of equality likely outcomes, mutually exclusive events. Probability of an event; Theorems on probability; Addition rule, Multiplication rule,

Independent experiments and events. Finding P (A or B), P (A and B), random variables, Probability distribution of a random variable.

UNIT V : CALCULUS

19. Functions, Limits and continuity

Concept of a real function; its domain and range; Modulus Function, Greatest integer function: Signum functions; Trigonometric functions and inverse trigonometric functions and their graphs; composite functions, Inverse of a function.

Limit of a function; meaning and related notations; Left and right hand limits; Fundamental theorems on limits without proof $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}, a>0; \lim_{x\to 0}\frac{Sinx}{x}=1; \lim_{x\to 0}\frac{e^x-1}{x}=1$ (without proof); $\lim_{x\to 0}\frac{\log(1+x)}{x}=1$

Limits at Infinity and infinity limits; continuity of a function at a point, over an open/ closed interval; Sum, Product and quotient of continuous functions; Continuity of special functions- Polynomial, Trigonometric, exponential, Logarithmic and Inverse trigonometric functions.

20. Differentiation

Derivative of a function; its geometrical and physical significance; Relationship between continuity and differentiability; Derivatives of polynomial, basic trigonometric, exponential, logarithmic and inverse trigonometric functions from first principles; derivatives of sum, difference, product and quotient of functions; derivatives of polynomial, trigonometric, exponential, logarithmic, inverse trigonometric and implicit functions; Logarithmic differentiation; derivatives of functions expressed in parametric form; chain rule and differentiation by substitution; Derivatives of Second order.

21. Application of Derivatives

Rate of change of quantities; Tangents and Normals; increasing and decreasing functions and sign of the derivatives; maxima and minima; Greatest and least values; Rolle's theorem and Mean value theorem; Approximation by differentials; Curve sketching of simple curves.

22. Indefinite Integrals

Integration as inverse of differentiation; properties of integrals; Integrals involving algebraic, trigonometric, exponential and logarithmic functions; Integration by substitution; Integration by parts; Integrals of the type:

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

$$\int\frac{px+q}{ax^2+bx+c}dx,\int\frac{dx}{\sqrt{ax^2+bx+c}},\int\frac{px+q}{\sqrt{ax^2+bx+c}}\,\mathrm{dx}.$$

Integration of rational functions; Partial fractions and their use in integration; Integrals of the type

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

$$\int\frac{dx}{a+b\cos x},\int\frac{dx}{a-b\sin x},\int Sin^{-1}x\,dx,\int\log x\,dx.$$

23. Definite Integrals

Definite integral as limit of a sum; Fundamental theorems of integral calculus without proof); Evaluation of definite integrals by substitution and by using the following properties.

$$\int_a^b f(x)\,dx=-\int_b^a f(x)dx\;;\int_a^b f(x)\,dx=\int_a^c f(x)\,dx+\int_c^b f(x)\,dx$$

$$\int_a^b f(x)\,dx=\int_a^b f(a+b-x)\,dx\;;\int_0^a f(x)\,dx=\int_0^a f(a-x)\,dx$$

$$\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx ; \int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$$

$$\int_0^{2a} f(x)\,dx = \int_0^a f(x)\,dx + \int_0^a f(2a-x)\,dx ; = \int_0^{2a} f(x)\,dx = 2\int_0^a f(x)dx, \text{ if } f(2a-x) = f(x) \quad \int_0^{2a} f(x)\,dx = 0, \text{ if } f(2a-x) = -f(x)$$

$$\int_{-a}^{a} f(x)\,dx = \begin{cases} 2\int_0^a f(x)\,dx, & \text{if } f(x) \text{ is even} \\ 0 \quad \text{if f(x) is odd} \end{cases}$$

Application of definite integrals in finding areas bounded by a curve, circle, parabola and ellipse in standard form between two ordinates and x-axis; Area between two curves, line and circle; line and parabola: line and ellipse.

24. Differential Equations

Definition; order and degree; general and particular solutions of a differential equation; formation of differential equations whose general solution is given; solution of differential equations by method of Separation of variables; Homogeneous differential equations of first order and their solutions; Solution of linear differential equations of the type $\frac{dy}{dx}+P(x)\,y=Q(x)$ where P (x), Q (x) are functions of x; Solutions of Second order differential equations $\frac{d^2y}{dx^2}=f(x)$.

PHYSICS

UNIT 1: INTRODUCTION AND MEASUREMENT

Physics – Scope and excitement; Physics in relation to science, society and technology – inventions, names of scientists and their fields, nobel prize winners and topics, current developments in physical sciences and related technology. Units for measurement – systems of units, S .I units, conversion from other systems to S.I units. Fundamental and derived units. Measurement of length, mass and time, least count in measuring instruments (eg. vernier calipers, screw gauge etc), Dimensional analysis and applications, order of magnitude, accuracy and errors in measurement, random and instrumental errors, significant figures and rounding off principles.

UNIT 2 : DESCRIPTION OF MOTION IN ONE DIMENSION

Objects in motion in one dimension – Motion in a straight line, uniform motion – its graphical representation and formulae; speed and velocity - instantaneous velocity; ideas of relative velocity with expressions and graphical representations; Uniformly accelerated motion, position – time graph, velocity – time graph and formulae. Elementary ideas of calculus – differentiation and integration – applications to motion.

UNIT 3 : DESCRIPTION OF MOTION IN TWO AND THREE DIMENSIONS

Vectors and scalars, vectors in two and three dimensions, unit vector, addition and multiplication, resolution of vector in a plane, rectangular components, scalar and vector products. Motion in two dimensions – projectile motion, ideas of uniform circular motion, linear and angular velocity, relation between centripetal acceleration and angular speed.

UNIT 4 : LAWS OF MOTION

Force and inertia, first law of motion, momentum, second law of motion, forces in nature, impulse, third law of motion, conservation of linear momentum, examples of variable mass situation, rocket propulsion, equilibrium of concurrent forces.

Static and kinetic friction, laws of friction, rolling friction, lubrication. Inertial and non-inertial frames (elementary ideas); Dynamics of uniform circular motion – centripetal and centrifugal forces, examples : banking of curves and centrifuge.

UNIT 5 : WORK, ENERGY AND POWER

Work done by a constant force and by a variable force, units of work – Energy – kinetic and potential forms, power, work-energy theorem. Elastic and inelastic collisions in one and two dimensions. Gravitational potential energy and its conversion to kinetic energy, spring constant, potential energy of a spring, Different forms of energy, mass – energy equivalence (elementary ideas), conservation of energy, conservative and non-conservative forces.

UNIT 6: MOTION OF SYSTEM OF PARTICLES AND RIGID BODY ROTATION.

Centre of mass of a two particle system, generalisation to N particles, momentum conservation and center of mass motion, applications to some familiar systems, center of mass of rigid body. Moment of a force, torque, angular momentum, physical meaning of angular momentum, conservation of angular momentum with some examples, eg. planetary motion. Equilibrium of rigid bodies, rigid body rotation and equation of rotational motion, comparison of linear and rotational motions, moment of inertia and its physical significance, radius of gyration, parallel and perpendicular axes theorems (statements only), moment of inertia of circular ring and disc, cylinder rolling without slipping.

UNIT 7 : GRAVITATION

Universal law of gravitation, gravitational constant (G) and acceleration due to gravity (g), weight and gravitation, variation of g with altitude, latitude, depth and rotation of earth. Mass of earth, gravitational potential energy near the surface of the earth, gravitational potential, escape velocity, orbital velocity of satellite, weightlessness, motion of geostationary and polar satellites, statement of Kepler's laws of planetary motion, proof of second and third laws, relation between inertial and gravitational masses.

UNIT 8 : MECHANICS OF SOLIDS AND FLUIDS.

Interatomic and intermolecular forces, different states of matter. **Solids :** Crystalline and amorphous solids, Hooke's law, stress – strain relationships, Youngs modulus, bulk modulus, shear modulus of rigidity, some practical examples. **Fluids :** Pressure due to fluid column, Pascal's law and its applications (hydraulic lift and hydraulic brakes), effect of gravity on fluid pressure, Buoyancy, laws of floatation and Archimedes principles, atmospheric pressure. Surface energy and surface tension, angle of contact, examples of drops and babbles, capillary rise, detergents and surface tension, viscosity, sphere falling through a liquid column, Stokes law, streamline flow, Reynold's number, equation of continuity, Bernoulli's theorum and applications.

UNIT 9 : HEAT AND THERMODYNAMICS

Kinetic theory of gases, assumptions, concept of pressure, kinetic energy and temperature, mean-rms and most probable speed, degrees of freedom, statement of law of equipartition of energy, concept of mean free path and Avogadros' number

Thermal equilibrium and temperatures, zeroth law of thermodynamics, Heat-work and internal energy, Thermal expansion – thermometry. First law of thermodynamics and examples, specific heat, specific heat of gases at constant volume and constant pressure, specific heat of solids, Dulong and Petit's law. Thermodynamical variables and equation of state, phase diagrams, ideal gas equation, isothermal and adiabatic processes, reversible and irreversible processes, Carnot engines, refrigerators and heat pumps, efficiency and coefficient performance of heat engines , ideas of second law of thermodynamics with practical applications. Thermal radiation – Stefan-Boltzmann law, Newton's law of cooling, Kirchoff's law and black body radiation, Wien's displacement law, solar constant and surface temperature of the sun.

UNIT 10 OSCILLATIONS

Periodic motion – period, frequency, displacement as a function of time and periodic functions; Simple harmonic motion (S.H.M) and its equation, uniform circular motion and simple harmonic motion, oscillations of a spring, restoring force and force constant, energy in simple harmonic motion, kinetic and potential energies, simple pendulum – derivation of expression for the period; forced and damped oscillations and resonance (qualitative ideas only), coupled oscillations

UNIT 11. WAVES

Longitudinal and transverse waves, wave motion, displacement relation for a progressive wave, speed of a traveling wave, principle of superposition of waves, reflection of waves, standing waves in strings and pipes, fundamental mode and harmonics, beats, Doppler effect of sound with applications.

UNIT 12: ELECTROSTATICS

Frictional electricity; Properties of electric charges - conservation, additivity and quantisation. Coulomb's law – Forces between two point electric charges, Forces between multiple electric charges; Superposition principle and continuous charge distribution. Electric field and its physical significance, electric field due to a point charge, electric field lines; Electric dipole, electric field due to a dipole and behavior and dipole in a uniform electric field. Electric potential-physical meaning, potential difference, electric potential due to a point charge, a dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of point charges, electric dipoles in an electrostatic field. Electric flux, statement of Gauss' theorem-its application to find field due to an infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Conductors and insulators-presence of free charges and bound charges; Dielectrics and electric polarization, general concept of a capacitor and capacitance, combination of capacitors in series and in parallel, energy stored in a capacitor, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, Van de Graff generator.

UNIT 13: CURRENT ELECTRICITY

Electric current, flow of electric charges in a metallic conductor, drift velocity and mobility, their relation with electric current; Ohm's law, electrical resistance, V-I characteristics, limitations of Ohm's law, electrical resistivity and conductivity, classification of materials in terms of conductivity; Superconductivity (elementary idea); Carbon resistors, colour code for carbon resistors; combination of resistances - series and parallel. Temperature dependence of resistance. Internal resistance of a cell, Potential difference and emf of a cell, combination of cells in series and in parallel. Kirchoff's laws-illustration by simple applications, Wheatstone bridge and its applications, Meter bridge. Potentiometer - principle and applications to measure potential difference, comparison of emf of two cells and determination of internal resistance of a cell. Electric power, thermal effects of current and Joule's law; Chemical effects of current, Faraday's laws of electrolysis, Electro-chemical cells, Primary and secondary cells, solid state cells. Thermoelectricity-origin, elementary ideas of Seebeck effect, Peltier effect and Thomson effect. Thermocouple, Thermo emf, neutral and inversion temperatures, Measurement of temperature using a thermo- couple.

UNIT 14: MAGNETIC EFFECT OF CURRENT AND MAGNETISM

Concept of a magnetic field, Oersted's experiment, Biot-Savart's law, magnetic field due to an infinitely long current carrying straight wire and a circular loop, Ampere's circuital law and its applications to straight and toroidal solenoids. Force on a moving charge in a uniform magnetic field, cyclotron. Force on current carrying conductor and torque on current loop in magnetic fields, force between two parallel current carrying conductors, definition of the ampere. Moving coil galvanometer and its conversion into ammeter and voltmeter. Current loop as a magnetic dipole, magnetic moment, torque on a magnetic dipole in a uniform magnetic field, Lines of force in magnetic field. Comparison of a bar magnet and solenoid. Earth's magnetic field and magnetic elements, tangent galvanometer, vibration magnetometer. Para, dia and ferromagnetic substances with examples. Electromagnets and permanent magnets.

UNIT 15: ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT

Electromagnetic induction, Faraday's laws, Induced e.m.f. and current, Lenz's law, Eddy currents, self and mutual inductance. Alternating current, peak and rms value of alternating current/voltage, reactance and impedance, L.C. oscillations, LCR series circuit. (Phasor diagram), Resonant circuits and Q-factor; power in A.C. circuits, wattless current.

AC generator and Transformer.

UNIT 16: ELECTROMAGNETIC WAVES

Properties of electromagnetic waves and Maxwell's contributions (qualitative ideas), Hertz's experiments, Electromagnetic spectrum (different regions and applications), propagation of electromagnetic waves in earth's atmosphere.

UNIT 17: OPTICS

Refraction of light, total internal reflection and its applications, spherical lenses, thin lens formula, lens maker's formula; Magnification, Power of a lens, combination of thin lenses in contact; Refraction and dispersion of light due to a prism, Scattering of light, Blue colour of the sky and appearance of the sun at sunrise and sunset. Optical instruments, Compound microscope, astronomical telescope (refraction and

reflection type) and their magnifying powers. Spectrometer -its use for determination of refractive index of the material of a prism. Wave front and Huygen's principle. Reflection and refraction of plane wave at a plane surface using wave fronts (qualitative idea); Interference-Young's double slit experiment and expression for fringe width, coherent sources and sustained interference of light; Diffraction due to a single slit, width of central maximum, difference between interference and diffraction, resolving power of microscope and telescope; Polarisation, plane polarised light, Brewster's law, Use of polarised light and polaroids.

UNIT 18: DUAL NATURE OF MATTER AND RADIATIONS

Photoelectric effect, Einstein photoelectric equation - particle nature light, photo-cell, Matter waves - wave nature of particles. De Broglie relation, Davisson and Germer experiment.

UNIT 19: ATOMIC NUCLEUS

Alpha particle scattering experiment, size of the nucleus - composition of the nucleus - protons and neutrons. Nuclear instability - Radioactivity-Alpha, Beta and Gamma particle/rays and their properties, radio- active decay laws, Simple explanation of ??decay, ?-decay and ??decay; mass-energy relation, mass defect, Binding energy per nucleon and its variation with mass number. Nature of nuclear forces, nuclear reactions, nuclear fission, nuclear reactors and their uses; nuclear fusion, elementary ideas of energy production in stars.

UNIT 20: SOLIDS AND SEMICONDUCTOR DEVICES

Energy bands in solids (qualitative ideas only), difference between metals, insulators and semi-conductors using band theory; Intrinsic and extrinsic semi-conductors, p-n junction, Semi-conductor diode-characteristics forward and reverse bias, diode as a rectifier, solar cell, photo-diode, zener diode as a voltage regulator; Junction transistor, characteristics of a transistor; Transistor as an amplifier (common emitter configuration) and oscillator; Logic gates (OR, AND, NOT, NAND, NOR); Elementary ideas about integrated circuits.

UNIT 21: PRINCIPLES OF COMMUNICATIONS

Elementary idea of analog and digital communication; Need for modulation, amplitude, frequency and pulse modulation; Elementary ideas about demodulation, Data transmission and retrieval, Fax and Modem. (basic principles) Space communications - Ground wave, space wave and sky wave propagation, satellite communications, ideas of remote sensing. Line communications - wire transmission lines, coaxial cables and optical fibres; telephone links, optical fibre communications (qualitative ideas)

CHEMISTRY

UNIT 1: BASIC CONCEPTS AND ATOMIC STRUCTURE

Laws of chemical combination: Law of conservation of mass. Law of definite proportion, Law of multiple proportions. Gay-Lussac's law of combining volumes. Dalton's atomic theory. Mole concept. Atomic, molecular and molar masses. Chemical equations. Balancing and calculation based on chemical equations.

Atomic structure: Fundamental particles. Rutherford model of atom. Nature of electromagnetic radiation. Emission spectrum of hydrogen atom. Bohr model of hydrogen atom. Drawbacks of Bohr model. Dual nature of matter and radiation. de Broglie relation. Uncertainty principle. Wave function (mention only). Atomic orbitals and their shapes (s, p and d orbitals only). Quantum numbers. Electronic configurations of elements. Pauli's exclusion principle. Hund's rule. Aufbau principle.

UNIT 2: BONDING AND MOLECULAR STRUCTURE

Kossel and Lewis approach of bonding. Ionic bond. Lattice energy. Born-Haber cycle. Covalent bond. Lewis structure of covalent bond. Concept of orbital overlap. VSEPR theory and geometry of molecules. Polarity of covalent bond. Valence bond theory and hybridization (sp, sp^2, sp^3, dsp^2, d^2sp^3 and sp^3d^2). Resonance. Molecular orbital method. Bond order. Molecular orbital diagrams of homodiatomic molecules. Bond strength and magnetic behaviour. Hydrogen bond. Coordinate bond. Metallic bond.

UNIT 3: STATES OF MATTER

Gaseous state: Boyle's law. Charles' law. Avogadro's hypothesis. Graham's law of diffusion. Absolute scale of temperature. Ideal gas equation. Gas constant and its values. Dalton's law of partial pressure. Aqueous tension. Kinetic theory of gases. Deviation of real gases from ideal behaviour. van der Waals equation. Liquefaction of gases. Joule-Thomson effect. Critical temperature.

Liquid state: Properties of liquids. Vapour pressure and boiling point. Surface tension. Viscosity.

Solid state: Types of solids (ionic, covalent and molecular). Space lattice and unit cells. Cubic crystal systems. X-ray studies of crystals. The Bragg equation. Close packing. Different voids (tetrahedral and octahedral only). Structures of simple ionic compounds of AB and AB_2 types. Density calculations. Point defects (Frenkel and Schottky). Electrical properties of solids. Conductors, semiconductors and insulators. Piezoelectric and pyroelectric crystals. Magnetic properties of solids. Diamagnetic, paramagnetic, ferromagnetic, antiferromagnetic and ferrimagnetic substances.

UNIT 4: PERIODIC PROPERTIES OF ELEMENTS AND HYDROGEN

Classification of elements: Mendeleev's periodic table. Atomic number and modern periodic law. Long form of periodic table. Electronic configurations of elements and their position in the periodic table. Classification into s-, p-, d- and f-block elements. **Periodic properties:** Ionization energy, electron affinity, atomic radii, valence and electronegativity.

Hydrogen: Position in the periodic table, occurrence, isolation, preparation (including commercial), properties, reactions and uses. Isotopes of hydrogen. **Hydrides:** Molecular, saline and interstitial hydrides. **Water:** Structure of water molecule and its aggregates. Physical and chemical properties of water. Hard and soft water. Removal of hardness. Preparation and uses of heavy water: Liquid hydrogen as fuel.

UNIT 5: S-BLOCK ELEMENTS AND PRINCIPLES OF METALLURGY

Alkali metals: Occurrence, electronic configuration, trends in atomic and physical properties (ionization energy, atomic radii and ionic radii), electrode potential, and reactions with oxygen, hydrogen, halogens and liquid ammonia. Oxides, hydroxides and halides.

Alkaline earth metals: Occurrence, electronic configuration, trends in atomic and physical properties, electrode potential, and reactions with oxygen, hydrogen and halogens. Oxides, hydroxides, halides and sulphides.

Anomalous properties of lithium and beryllium. **Compounds of s-block elements:** Large scale preparation of NaOH and Na_2CO_3, their properties and uses. Preparation and properties of CaO, $Ca(OH)_2$, Plaster of Paris and $MgSO_4$. Industrial uses of lime, limestone and cement.

Principles of metallurgy: Occurrence of metals. Concentration of ores. General principles of extraction of metals from ore. Refining of metals. Extraction of sodium, aluminium, iron and copper. Manufacture of steel. Different types of steel. Heat treatment and uses of steel.

UNIT 6: P-BLOCK ELEMENTS

General characteristics of p-block elements: atomic and physical properties. Oxidation states. Trends in chemical reactivity of Groups 13, 14, 15, 16 and 17 elements.

Boron: Occurrence, isolation, physical and chemical properties. Borax and boric acid. Boron hydrides. Structure of diborane. Uses of boron and its compounds. **Carbon:** Allotropes, properties, carbides, halides and sulphide. **Nitrogen:** Terrestrial abundance and distribution, isolation, properties and chemical reactivity. Fixation of nitrogen. **Ammonia:** Haber process of manufacture, properties and uses. **Nitric acid:** Ostwald process of manufacture and important uses. **Oxides of nitrogen:** Preparation and structures (skeletal only). **Oxygen:** Terrestrial abundance, isolation, properties and chemical reactivity. **Oxides:** Acidic, basic and amphoteric oxides. Preparation, structure, properties and uses of ozone and hydrogen peroxide.

Silica: Different forms and uses. Structures of silicates. **Phosphorus:** Production, allotropes and phosphine. Preparation and structures of PCl_3, PCl_5, P_4O_6, P_4O_{10}, oxyacids of phosphorus. Comparison of halides, hydrides and oxides of Group 15 elements. **Sulphur:** Production, allotropes, oxides and halides. **Hydrogen sulphide:** Preparation, properties and uses in qualitative analysis. **Sulphuric acid:** Manufacture, properties and uses. Preparation and properties of $Na_2S_2O_3$. Comparison of oxides, halides and hydrides of Group 17 elements. Hydrides, oxides and oxyacids of chlorine. Preparation and properties of bleaching powder. Interhalogen compounds.

Group 18 elements: Occurrence, isolation, atomic and physical properties, uses. **Compounds of xenon**: Preparation of fluorides and oxides, and their reactions with water.

UNIT 7: D-BLOCK AND F-BLOCK ELEMENTS

d-Block elements: Electronic configuration and general characteristics. Metallic properties, ionization energy, electrode potential, oxidation states, ionic radii, catalytic properties, coloured ions, complex formation, magnetic properties, interstitial compounds and alloys. Preparation and properties of $KMnO_4$, $K_2Cr_2O_7$, $CuSO_4.5H_2O$, $AgNO_3$, and halides of silver and mercury. Photography.

f-Block elements: Lanthanides: Occurrence, electronic configuration and oxidation states. Lanthanide contraction. Uses. **Actinides:** Occurrence, electronic configuration and comparison with lanthanides.

UNIT 8: NUCLEAR CHEMISTRY

Natural radioactivity: Properties of alpha, beta and gamma radiations. Group displacement law. Nuclear stability and binding energy. Nuclear reactions. Radioactive disintegration series. Rate of radioactive disintegration and half life. **Artificial radioactivity:** Transmutation of elements. Nuclear energy. Nuclear fission and nuclear fusion. Nuclear reactors. Radio isotopes and their uses. Radiochemical dating. Synthetic elements.

UNIT 9: THERMODYNAMICS

System and surrounding: Types of systems. Types of processes. Intensive and extensive properties. State functions and path functions. Reversible and irreversible processes. Zeroth law. **First law of thermodynamics:** Internal energy and enthalpy. Application of first law of thermodynamics. Enthalpy changes during phase transition. Enthalpy changes in chemical reactions. Standard enthalpy of formation. Hess's law of constant heat summation and numerical problems. **Second law of thermodynamics:** Entropy and Gibbs free energy. Free energy change and chemical equilibrium. Criteria for spontaneity.

UNIT 10: CHEMICAL EQUILIBRIUM

Physical and chemical equilibria: Dynamic nature of equilibrium. Equilibria involving physical changes (solid-liquid, liquid-gas, dissolution of solids in liquids and dissolution of gases in liquids). General characteristics of equilibria involving physical processes. **Equilibria involving chemical systems:** Law of chemical equilibrium. Magnitude of equilibrium constant. Numerical problems. Effect of changing conditions of systems at equilibrium (changes of concentration, temperature and pressure). Effect of catalyst. The Le Chatelier principle and its applications. Relationship between K_p and K_c. Ionic equilibrium. Ionization of weak and strong electrolytes. **Concepts of acids and bases:** Those of Arrhenius, Bronsted-Lowry and Lewis. Acid-base equilibrium. Ionization of water. pH scale. Salt hydrolysis. Theory of acid-base indicators. Solubility product. Common ion effect. Buffer action and buffer solutions.

UNIT 11: SOLUTIONS

Types of solutions: Different concentration terms (normality, molarity, molality, mole fraction and mass percentage). Solubility of gases and solids. Vapour pressure of solutions and Raoult's law. Deviation from Raoult's law. **Colligative properties**: Lowering of vapour pressure, elevation in boiling point, depression in freezing point and osmotic pressure. Ideal and non-ideal solutions. Determination of molecular mass. Abnormal molecular mass. The van't Hoff factor and related numerical problems

UNIT 12: REDOX REACTIONS AND ELECTROCHEMISTRY

Oxidation and reduction: Electron transfer concept. Oxidation number. Balancing equations of redox reactions: Oxidation number method and ion electron method (half reaction method).

Faraday's laws of electrolysis: Quantitative aspects. Electrolytic conduction. Conductance. Molar conductance. Kohlrausch's law and its applications. Electrode potential and electromotive force (e.m.f.). Reference electrode (SHE only). Electrolytic and Galvanic cells. Daniel cell. The Nernst equation. Free energy and e.m.f. Primary and secondary cells. Fuel cell (H_2-O_2 only). **Corrosion and its prevention:** Electrochemical theory of rusting of iron. Methods of prevention of corrosion. Galvanization and cathodic protection.

UNIT 13: CHEMICAL KINETICS

Rate of reaction. Average and instantaneous rates. Rate expressions. Rate constant. Rate law. Order and molecularity. Integrated rate law expressions for zero and first order reactions and their derivations. Units of rate constant. Half life period. Temperature dependence of rate constant. Arrhenius equation. Activation energy and related numerical problems. Elementary and complex reactions with examples.

UNIT 14: SURFACE CHEMISTRY

Adsorption: Physical and chemical adsorption. Factors affecting adsorption. Effect of pressure. Freundlisch adsorption isotherm. Langmuir adsorption isotherm. Catalysis. Enzymes. Zeolites. **Colloids:** Colloids and suspensions. Dispersion medium and dispersed phase. Types of colloids: Lyophobic, lyophilic, multimolecular, macromolecular and associated colloids. Preparation, properties and protection of colloids. Gold number. Hardy Schulze rule. Emulsions.

UNIT 15: COORDINATION COMPOUNDS AND ORGANOMETALLICS

Ligand. Coordination number. IUPAC nomenclature of coordination compounds. Isomerism in coordination compounds. Geometrical, optical and structural isomerism. Bonding in coordination compounds. Werner's coordination theory. Valence bond approach. Hybridization and geometry. Magnetic properties of octahedral, tetrahedral and square planar complexes. Introduction to crystal field theory. Splitting of d orbitals in octahedral and tetrahedral fields (qualitative only). Importance of coordination compounds in qualitative analysis and biological systems such as chlorophyll, hemoglobin and vitamin B_{12} (structures not included).

UNIT 16: BASIC PRINCIPLES, PURIFICATION AND CHARACTERIZATION OF ORGANIC COMPOUNDS

Distinction between organic and inorganic compounds. Tetra valence of carbon. Catenation. Hybridization (sp, sp^2 and sp^3). Shapes of simple molecules. General introduction to naming of organic compounds. Trivial names and IUPAC nomenclature. Illustrations with examples. Structural isomerism. Examples of functional groups containing oxygen, hydrogen, sulphur and halogens. **Purification of carbon compounds:** Filtration, crystallization, sublimation, distillation, differential extraction and chromatography (column and paper only). **Qualitative analysis:** Detection of carbon, hydrogen, nitrogen and halogens. **Quantitative analysis:** Estimation of carbon, hydrogen, nitrogen, sulphur, phosphorus and halogens (principles only), and related numerical problems. **Determination of molecular mass:** Silver salt method and chloroplatinate salt method. Calculation of empirical and molecular formulae.

UNIT 17: HYDROCARBONS

Classification of hydrocarbons. **Alkanes and cycloalkanes:** Nomenclature and conformation of ethane, propane, butane and cyclohexane. 3D structures and 2D projections (Sawhorse and Newman). **Alkenes and alkynes:** Nomenclature. Geometrical isomerism in alkenes. Stability of alkenes. General methods of preparation. Physical and chemical properties. Markownikoff's rule. Peroxide effect. Acidic character of alkynes. Polymerization reactions of dienes.

Aromatic hydrocarbons: Nomenclature. Isomerism. Source of aromatic hydrocarbons. Coal and petroleum. Benzene and its homologues. Structure of Benzene. Resonance. Delocalisation in benzene. Concept of aromaticity (an elementary idea). Chemical reactions of benzene. Polynuclear hydrocarbons and their toxicity.

Petroleum and petrochemicals: Composition of crude oil. Fractionation. Uses of different fractions. Quality of gasoline. LPG and CNG. Cracking and reforming of petrochemicals

UNIT 18: ORGANIC REACTION MECHANISM

Electronic displacement in a covalent bond: Inductive, electromeric, resonance and hyperconjugation effects. Fission of a covalent bond. Free radicals, electrophiles, nucleophiles, carbocations and carbanions.

Common types of organic reactions: Substitution, addition, elimination and rearrangement reactions. Illustrations with examples. Mechanism of electrophilic addition reactions in alkenes. Concept of delocalisation of electrons. Addition reactions in dienes (1,2– and 1,4- additions). Mechanism of electrophilic substitution reactions. Directive influence of substituents and their effect on reactivity (in benzene ring only).

UNIT 19: STEREOCHEMISTRY

Stereoisomerism: Geometrical isomerism and optical isomerism. Specific rotation. Chirality and chiral objects. Chiral molecules. Configuration and Fischer projections. Asymmetric carbon. Elements of symmetry. Compounds containing one chiral center. Enantiomers. Racemic form. Racemization. Compounds containing two chiral centers. Diastereo isomers. Meso form. Resolution. Importance of stereochemistry.

UNIT 20: ORGANIC COMPOUNDS WITH FUNCTIONAL GROUPS CONTAINING HALOGENS

Haloalkanes and haloarenes: Nomenclature and general methods of preparation. Physical properties. Nature of C-X bond in haloalkanes and haloarenes. Chemical properties and uses of chloromethane and chlorobenzene. **Polyhalogen compounds:** Preparation and properties of chloroform and iodoform. Uses of some commercially important compounds (chloroform, iodoform, DDT, BHC and freon).

UNIT 21: ORGANIC COMPOUNDS WITH FUNCTIONAL GROUPS CONTAINING OXYGEN

Alcohols: Nomenclature. Important methods of preparation (from aldehydes, ketones, alkyl halides and hydration of alkenes). Manufacture of ethanol from molasses and starch. Physical and chemical properties. Reactions with alkali metals and acids. Formation of alkenes, ethers and esters. Reactions with PX_3, PX_5, $SOCl_2$. Oxidation of alcohols. Dehydrogenation.

Phenols: Nomenclature. Preparation of phenol (from sodium benzenesulphonate, benzene diazoniumchloride and chlorobenzene). Physical and chemical properties of phenol. Acidity of phenol. Action of phenol with $FeCl_3$. Bromination, sulphonation and nitration of phenol.

Ethers: Nomenclature. Methods of preparation (from alcohols and alkyl halides). Williamson's synthesis. Physical and chemical properties. Formation of peroxides. Actions with HI, HF and H_2SO_4.

Some commercially important compounds: Methanol, ethanol (fermentation), glycol and glycerol. Ascending and descending in alcohol series.

Aldehydes and ketones: Nomenclature. Electronic structure of carbonyl group. Methods of preparation (from alcohols, acid chlorides, ozonolysis of alkenes and hydration of alkynes). Friedel-Crafts acylation for acetophenone. General properties (physical and chemical) of aldehydes and ketones. Formation of paraldehyde and metaldehyde. Addition of $NaHSO_3$, NH_3 and its derivatives, Grignard reagent, HCN and alcohols. Oxidation reactions with Tollen's reagent and Fehling's solution. Oxidation of ketones. Reduction with $LiAlH_4$. Clemmensen reduction. Wolff- Kischner reduction. Aldol condensation. Cannizzaro reaction.

Carboxylic acid: Nomenclature. Electronic structure of –COOH. Methods of Preparation (from alcohols, aldehydes, ketones, alkyl benzenes and hydrolysis of cyanide). Physical properties. Effects of substituents on acid strength. Chemical reactions.

Derivatives of carboxylic acids: Nomenclature. Esters, acid chlorides, amides and anhydrides. Important methods of preparation.

UNIT 22: ORGANIC COMPOUNDS WITH FUNCTIONAL GROUPS CONTAINING NITROGEN

Nitrocompounds: Nomenclature. Electronic structure of nitro group. Preparation and properties. **Amines:** Nomenclature. Primary, secondary and tertiary amines. Methods of preparation. Physical properties. Basic nature. Chemical reaction. Separation of primary, secondary and tertiary amines. Cyanides and isocyanides. Diazonium salts. Preparation and chemical reactions of benzene diazoniumchloride in synthetic organic chemistry.

UNIT 23: POLYMERS AND BIOMOLCULES

Polymers: Classification. Addition and condensation polymerization. Copolymerization. Natural rubber and vulcanization. Synthetic rubbers. Condensation polymers. Biopolymers. Biodegradable polymers. Some commercially important polymers: Polyethene, polystyrene, PVC, Teflon, PAN, BUNA-N, BUNA-S, neoprene, Terylene, glyptal, nylon-6, nylon-66 and Bakelite.

Biomolecules: The cell energy cycle. Classification of carbohydrates. Structure and properties of glucose. **Reducing and non-reducing sugars:** Properties of sucrose, maltose and lactose (structures not included). **Polysaccharides:** Properties of starch and cellulose. **Proteins**: Amino acids. Zwitterions. Peptide bond. Polypeptides. Primary, secondary and tertiary structures of protein. Denaturation of proteins. Enzymes. Nucleic acids. Types of nucleic acids. DNA and RNA, and their chemical composition. Primary structure of DNA. Double helix. Replication, translation and transcription. Protein synthesis. Genetic code. **Lipids:**

Classification, structural features and functions in biosynthesis. **Hormones:** Classification, structural features and functions in biosystems. **Vitamins:** Classification and functions in biosystems.

UNIT 24: ENVIRONMENTAL CHEMISTRY AND CHEMISTRY IN EVERY DAY LIFE

Soil, water and air pollutions. Ozone layer. Smog. Acid rain. Green house effect and global warming. Industrial air pollution. Importance of green chemistry.

Chemicals in medicine and health care. Analgesics, tranquillizers, antiseptics, antacids and dyes. Classification of dyes with examples. Indigo, methyl orange and alizarin. Chemicals in cosmetics: Creams, perfumes, talc powder and deodorants. Advanced materials: Carbon fibers, ceramics, chemicals in food, preservatives, artificial sweetening agents, antioxidants and edible colours. Insect repellents. Pheromones. Sex attractants. Rocket propellants: Characteristics and chemicals used.

BIOLOGY

UNIT 1: LIVING WORLD

Biology and its branches: relationship with other sciences; scientific methods in biology; historical break through (ancient, medieval and modern); scope in biology and career options; role of Biology in dispelling myths and misbelieves; Characters of living organisms (elementary ideas of organization, metabolism, energy transfer devices of life, homeostasis, growth and reproduction, adaptation, survival and death).

UNIT 2: DIVERSITY OF PLANT LIFE

2.1 Systematics/Taxonomy and its importance; Artificial, natural and phylogenetic types of classifications with examples; Biosystematics; Binomial nomenclature (guidelines and merits); Systems of classification: a) Two Kingdom (brief description with emphasis on criteria and demerits). b) Five Kingdom (brief description with emphasis on criteria, merits and demerits); Descriptive features of kingdoms: Monera, Protista, Fungi, Plantae and Animalia; Status of virus; Botanical gardens and herbaria.

2.2 Plant Groups

I. Thallophyta

a) Algae: Salient, comparative features of Rhodophyta, Phaeophyta and Chlorophyta with examples.

b) Fungi: Salient features of Myxomycetes, Phycomycetes, Ascomycetes and Basidiomycetes with examples.

c) Lichens: General features with examples.

Bryophyta: General features with special mention on aquatic to terrestrial evolution; alternation of generations of Hepaticae and Musci with examples.

Pteridophytes : General features with examples.

IV. Gymnosperms: General features with examples.

V. Angiosperms: Unique features of angiosperms with examples.

2.3 Morphology of Angiosperms

Morphological structures of root, stem and leaf: Their structural and functional modification with examples.

Inflorescence: Racemose, Cymose (different sub-types with examples), Special types (Cyathium, Verticillaster, Hypanthodium). Morphological characters of flower; Morphological differentiation of different types of fruits and seeds with examples.

2.4 Taxonomy of Angiosperms : Description on classification of angiosperms upto series level (Benthem and Hooker's System).

Description of Taxonomical Types (With floral diagram and floral formula)

1. Malvaceae - Eg. Hibiscus rosasinensis.
2. Fabaceae (Papilionaceae) - Eg. *Crotalaria* sp.
3. Rubiaceae - Eg. *Ixora* sp
4. Asteraceae (Compositae) - Eg. *Tridax* sp.

5. Liliaceae - Eg. *Gloriosa* sp.
6. Poaceae - Eg. *Oryza* sp.
(Graminae)

2.5 Plant Anatomy

Tissue: Meristematic (Classification based on origin, position and plane of division); Permanent (Simple and complex types); Tissue systems (epidermal, ground and vascular); Anatomy of root and stem (primary structure) of monocot and dicot; Anatomy of leaf of monocot and dicot; Normal secondary growth of stem and root.

UNIT 3: CELL AND CELL DIVISION

3.1 Cell as a basic unit of life; Cell theory; Cell as a self-contained unit, unicellularity and multicellularity, prokaryotic and eukaryotic systems.

Tools and techniques: Different types of optical microscope, electron microscope and cell fractionation (centrifugation, chromatography and electrophoresis).

3.2 Ultra Structure: Prokaryotic and eukaryotic cell, cell wall, cell membrane (Fluid Mosaic Model), unit membrane concept, membrane transport, cellular movements (endocytosis and exocytosis); Description of cell organelles and their functions (nucleus, mitochondria, plastids, endoplasmic reticulum, golgi bodies, lysosomes, cytoskeletal structures, cilia and flagella, centriole, ribosomes).

3.3 Macromolecules of cell: Inorganic and organic materials (water, salt, mineral ions, carbohydrates, lipids, amino acids, proteins, nucleotides, nucleic acids (RNA and DNA), enzymes (properties, chemical nature and mechanism of action), vitamins, hormones and steroids.

3.4 Cell cycle: Cell division, description of amitosis, mitosis and meiosis – their significance, differences in animal and plant cell divisions, karyotype analysis.

UNIT 4: PHYSIOLOGY OF PLANTS

Cell as a Physiological Unit: composition of protoplasm, water relations (imbibition, diffusion, osmosis, plasmolysis, permeability, water potential), absorption and movement – active (osmotic and non-osmotic) and passive.

Translocation of water: Theories -- root pressure, transpiration pull. Transpiration: Mechanism of opening and closing of stomata (potassium ion theory), factors affecting stomatal movement, factors affecting rate of transpiration, guttation, significance of transpiration.

Mineral nutrition: Functions of minerals, essential major elements and trace elements, deficiency symptoms of elements. Theories of translocation - passive (diffusion, ion exchange, mass flow, Donnan's equilibrium), active (carrier concept); Translocation of solutes (Stout and Hoagland concept). Nitrogen metabolism: Nitrogen cycle, biological nitrogen fixation, mechanism, synthesis of amino acids (reductive amination, transamination, amides).

Photosynthesis: Significance, photosynthetic apparatus, functional aspects of chlorophyll structure, action spectra and absorption spectra. Mechanism: Photochemical phase, photo phosphorylation (cyclic and non cyclic electron transport system), biosynthetic phase (C_3, C_4 and CAM pathways); Photorespiration and its mechanism; Factors affecting photosynthesis (Blackmann's law of limiting factor). Mode of nutrition: Autotrophic, heterotrophic, saprophytic and parasitic. Insectivorous plants. Chemosynthesis.

Respiration: Significance, site of respiration, mechanism: Glycolysis, Kreb's cycle, electron transport system and oxidative phosphorylation, pentose phosphate pathway: Respiratory quotient, compensation point; Anaerobic respiration, fermentation; Factors affecting respiration.

UNIT – 5 – REPRODUCTION, GROWTH AND DEVELOPMENT

Modes of reproduction in flowering plants

Vegetative propagation (natural and artificial), micro-propagation, significance. Sexual reproduction: Development of male and female gametophytes, pollination types and factors, double fertilization, incompatibility; embryo development, seed and fruit development, parthenogenesis and parthenocarpy.

Plant Growth

Characteristic features, measurement of growth, growth curve, growth rate, growth regulators (phytohormones): auxins, gibberellins, cytokines, ethylene, abscisic acid (ABA) and their role. Seed germination: types, mechanism and factors affecting germination, role of growth regulators in seed

dormancy. Senescence, abscission, stress factors (salt and water) and growth. Plant movements: phototropism, geotropism, hydrotropism, turgor growth movements (tropic, nastic and nutation), Process of flowering, photoperiodism and vernalisation.

UNIT 6: ECOLOGY AND ENVIRONMENT

Organisms and their environment: Factors: abiotic (air, water, soil, temperature and light) and biotic; Range of tolerance, acclimatization, ecological adaptation to different environments in plants.

Levels of organization: Population, species, community, ecosystem and biosphere; Ecological interactions: Symbiosis, mutualism, commensalism, parasitism, predation and competition.

Ecosystem: Structure and function with respect to aquatic and terrestrial ecosystems (pond and grassland), productivity, energy flow, ecological efficiencies, decomposition and nutrient cycling (nitrogen and phosphorus cycle). Major biomes: Forest, grassland and deserts.

Ecological succession: Types and mechanism. Natural resources: Types: Inexhaustible. Exhaustible (renewable and non renewable). Principal natural resources: Soil, water, land, forest, energy, marine, mineral, Forest and wild life resource. Use and misuse of natural resources.

Environmental pollution: Sources of air, water, soil and noise pollution; Major pollutants in big cities in our country; their effects and methods of control. Pollution due to radioactive substances. Disposal of nuclear wastes. Effect and control of radiation pollution.

Global environmental changes: green house gases, global warming, sea level rise, and ozone layer depletion.

UNIT 7 – APPLICATIONS OF BIOLOGY

Food production, breeding, improved varieties, bio-fertilizers, crop and animal diseases, bio-pesticides.

Plant tissue culture and its application, genetically modified food, bio-war, bio-piracy, bio-patent, biotechnology and sustainable agriculture.

UNIT 8 - ORIGIN AND EVOLUTION OF LIFE

1. Origin of Earth 1.1 Theory of Origin of Earth 1.1.1 Big Bang Theory

2. Origin of Life 2.1 Various Theories 2.1.1 Special Creation 2.1.2 Cosmic (extra terrestrial)origin, 2.1.3 abiogenic origin (chemical evolution) 2.1.4 Oparin-Haldane Hypothesis.

3. Primary abiogenesis 3.1 Harold Urey & Stanley Miller experiment 3.1.1 Primitive conditions of earth 3.1.2 Formation of biopolymers 3.1.4 factors required for polymeric biomolecules 3.1.5 Conditions required for origin of life 3.1.6 Protobionts, coacervates, microsphores, purine & pyrimidine bases of nucleic acids.

4. Theories of Evolution 4.1.1 Plato – Eidos 4.1.2 Aristotle, Ladder of Nature or Scala , Nature or Great Chain of being 4.1.3 Lamarckism (J.B.Lamarck) -Theory of Inheritance of Acquired Characters or Theory of Use and Disuse 4.1.4 Principle & Criticism (NeoLamarckism).

5. Darwin's Theory of Evolution 5.1 Natural Selection 5.1.1 Principle of Natural Selection – 5.1.2 Example of Natural Selection - Industrial Melanism 5.1.3 Criticism of Darwin's Theory – 5.1.4 Neodarwinism.

6. Mutation Theory of de Vries 6.1.1 Observation on *Oenothera lamarckiana* 6.1.2 Principles & Criticism of Theory of Mutation.

7. Evidences of Evolution 7.1.1 Palaentological, Embryological 7.1.2 Morphological 7.1.3 Anatomical 7.1.4 Biogeographical.

8. Variation 8.1 Definitions 8.1.2 Sources of Variation 8.1.3 Mutation 8.1.4 Recombination 8.1.4 Genetic drift 8.1.5 Gene migration and natural Selection.

9. Population Genetics & Evolution 9.1 Hardy Weinberg Equilibrium.

10. Genetic Basis of Adaptation 10.1.1 Replica plating experiment of Lederberg and Lederberg 10.1.2 Genetic Polymorphism – Eg: Blood group & sickle cell anaemia

11. Speciation – 11.1.1 Allopatric & Sympatric speciation 11.1.2 Species concept 11.1.3 Sibling species, Polytypic species 11.1.4 Evolutionary species concept

12. Isolation 12.1.1 role of Isolation in speciation 12.1.2 Geographical isolation 2.1.3 Reproductive isolation.

UNIT 9 – CLASSIFICATION OF ANIMALS

1. Salient features of different Phyla with examples. 1.1 General features of animals 1.1.1 Grades of organization and body plan 1.1.2 body symmetry 1.1.3 germ layers (diploblastic & triploblastic organization) 1.1.4 segmentation 1.1.5 coelom 1.1.6 Heterotrophic mode of Nutrition 1.1.7 Movement 1.1.8 Reproduction and Development

Kingdom Protista (Protozoan Protists only) eg: Amoeba, Paramecium, Trypanosoma, Entamoeba, Plasmodium

Phylum Porifera eg: Sycon, Leucosolenia, Spongilla

4. **Phylum Cnidaria** eg: Hydra, Obelia colony, Physalia, Aurelia, Sea Anemone, Corals
5. **Phylum Playhelminthes** eg.: Taenia, Fasciola, Planaria

Phylum Nemathelminthes eg: Ascaris, Rhabditis, Wuchereria, Ancylostoma

7. **Phylum Annelida** eg: Nereis, Aphrodite, Pheretima, Hirudinaria, Chaetopterus, Bonellia

8. **Phylum Arthropoda** eg: Araneus (Spider), Limulus (King Crab), Bruthus (Scorpion), Eupgurus (Hermit Crab), Penaeus (Marine prawn), Palaemon (fresh water prawn), Lepisma, Apis, Musca (House fly), Mosquito, Leptocorisa (paddy pest), Barnacles, Silk worm, Oryctes

9. **Phylum Mollusca** eg: Pila, Mussel (fresh water & marine), Pinctada, Loligo, Octopus, Teredo

Phylum Echinodermata eg: Asterias, Echinus, Antedon, Sea cucumber, Ophiura.

PHYLUM CHORDATA: Subphylum [a]-Hemichordata eg: Balanoglossus Subphylum [b]- Urochordata eg: Ascidia.. Subphylum [c] - Cephalochordata eg: Amphioxus Subphylum [d]-Vertebrata–Classification up to classes

Super class I. Agnatha. *Class* – Cyclostomata eg: Petromyzon and Myxine.

Super class II. Gnathostomata *Class a* - Chondrichthyes (Cartilaginous fishes) eg.: Scoliodon, Trygon, Torpedo (Narcine), Pristis. *Class b.* Osteichthyes (Bony fishes) eg.: Catla, Anabas, Channa, Exocoetus, Remora, Hippocampus, Tuna, Cybium, Pomfret, Etroplus, Tilapia, Sardine, Mackeral. *Class c.* Amphibia eg: Bufo, Rana, Hyla, Rhacophorus, Salamander, Amblystoma, Ichthyophis Class *d. Reptilia* eg: Chelone, Testudo, Sphenodon, Hemidactylus, Chameleon, Calotes, Draco, Phrynosoma, Varanus, Python, Naja, Krait, Viper, Crocodile, Alligator, Gavialis, Crotalus, Enhydrina, Dryophis, Typhlops. *Class e.* Aves eg: Ardea (Grey Heron), Corvus, Paro, Gallus, Columba, Psittacula, Bubo, Milvus, Struthio (Ostrich), Kiwi, *Class f.* Mammalia eg: Platypus, Kangaroo, Mole, Bat, Whale, Loris, Macaques, *Macaca radiata*, *Macaca silenus* (Lion-tailed monkey) Common Langur, Gorilla, Chimpanzee, Orangutan, Panthera, Elephas.

UNIT 10 - ANIMAL MORPHOLOGY

1. External and internal morphology 1.1 Earthworm 1.2 Cockroach 1.3 Frog 1.4 Rat.

UNIT 11 - ANIMAL TISSUES

1. Definition 1.1.1 Types of tissues 1.1.2 Epithelial tissue - different types with examples, specialized epithelial tissue with examples 1.1.3 Connective tissue with examples 1.1.4 Muscular tissue with examples 1.1.5 Nervous tissue with examples 1.1.6 Structure and functions of these tissues.

UNIT 12 - GENETICS

1. Heredity and variation -1.1.1 Mendel's experiments 1.1.2 Laws of Mendel 1.1.3 Chromosome theory of inheritance 1.1.4 Pattern of inheritance 1.1.5 Incomplete dominance 1.1.6 Epistasis 1.1.7 Multiple allelism 1.1.8 Quantitative inheritance 1.1.9 Pleiotropy

2. Chromosomes 2.1.1 Prokaryotic & Eukaryotic Chromosomes 2.1.2 Nucleosomes 2.1.3 Chromosome theory of inheritance 2.1.4 Concept of linkage and crossing over recombination 2.1.5 Principle of gene mapping 2.1.6 sex linked inheritance 2.1.7 sex determination 2.1.8 sex limited and sex influenced inheritance.

3. Mutation 3.1 Gene mutation – 3.1.1Chromosomal aberration 3.1.2 Polyploidy, aneuploidy and Euploidy 3.1.3 Mutation causing agents.

4. Human Genetics 4.1 Pedigree Analysis 4.2 Genetic Disorders 4.2.1 Sickle cell anaemia 4.2.2 Phenylketonuria 4.2.3 Alzheimer's disease 4.2.4 Down's Syndrome 4.2.5 Turner's Syndrome 4.2.6 Klinefelter's Syndrome.

5. Nature of Genetic Material 5.1 DNA and its structure 5.1.1 Different types of DNA 5.12 RNA and its structure 5.1.3 Experiments to prove genetic nature of DNA.

6. DNA and Gene 6.1 DNA Replication 6.1.2 Gene expression- Gene and Protein 6.1.3 Biosynthesis of Protein 6.2 Regulation of Gene expression in prokaryotes and eukaryotes- 6.2.1House keeping genes 6.3 Genes in differentiation and development 6.4 Oncogenes.

UNIT 13 - APPLIED GENETICS

1. Recombinant DNA technology 1.1 Genetic Engineering and its tools 1.1 gene transfer 1.1.2 application of recombinant DNA technology 1.1.3 Gene Library 1.1.4 Medical Diagnosis of diseases.

2. Cloning 2.1 various types of cloning 2.1.1 Microbial cloning 2.1.2 Cell cloning 2.1.3 Plant cloning. 2.1.4 Animal cloning 2.1.5 transgenic organisms (Plant, animals and microbes)

3. Genomics 3.1 Principles and application 3.1.1 Human genome project 3.1.2 DNA Diagnosis 3.1.3 Gene Therapy 3.1.4 DNA finger printing 3.1.5 ethical, legal, social concerns associated with gene manipulations.

UNIT 14 - PHYSIOLOGY OF ANIMALS

1. Nutrition 1.1.1 Different types of nutrition 1.1.2. Different types of nutrients 1.1.3. Malnutrition 1.1. 4. Under nutrition 1.1. 5. Disorders related to nutrition.

2. Digestion 2.1.1. Intracellular and Extracellular digestion with examples. 2.1.2. Digestive system of Cockroach. 2.1.3. Glands associated with the alimentary canal. 2.1.4. Different enzymes secreted by the alimentary canal. 2.1.5. Bacteria involved in the synthesis of enzymes. 2.1.6. Functions of various enzymes. 2.1.7. Role of various regions of alimentary canal in absorption. 2.2. Human Digestive System. 2.2.1. Structure of alimentary canal and associated glands and their secretions. 2.2.2. Buccal cavity and structures associated with it. 2.2.3. Process of ingestion and digestion at various regions of alimentary tract. 2.2.4. Mechanism of absorption and assimilation of digested food components. 2.2.5. Egestion 2.2.6. Role of gastrointestinal hormones in digestion.

3. Respiration 3.1.1. Aerobic Respiration 3.1.2. Anaerobic respiration. 3.2 Respiration in cockroach. 3.2.1. Spiracles and tracheal system 3.2.2 Haemocoel 3.2.3 Mechanism of gas exchange. 3.3 Human Respiratory system. 3.3.1. Respiratory organs and mechanism involved in pulmonary respiration. 3.3.2. Gas exchange and transport of respiratory gases. 3.3.3 Respiratory pigments involved 3.3.4 Regulation of respiration 3.4 Respiratory disorders 3.4.1 Bronchitis 3.4.2 Bronchial Asthma3.4.3 Emphysema 3.4.4 Pneumonia 3.4.5 Occupational lung diseases 3.4.6 Causes of these disorders – symptoms, prevention and cure of these disorders 3.4.7 High altitude problems – mountain sickness, asphyxia and hypoxia 3.5 Carbon Monoxide poisoning.

4. Circulation 4.1.1 Open circulatory system with examples 4.1.2 Closed circulatory system with examples 4.1.3 composition of blood 4.1.4 structure and functions of different types of blood cells. 4.2 Structure and working of heart 4.2.1 pulmonary, systemic and portal circulation 4.2.2 Pulse, heart beat and blood pressure 4.2.3 Rhythmicity of heart 4.2.4 Regulation of heart beat 4.2.5 Blood related disorders – hypertension, atherosclerosis and arteriosclerosis 4.2.6 Echo cardio gram 4.2.7 Pacemaker 4.3 Lymphatic system 4.3.1 Lymph 4.3.2 Lymph node 4.3.3 Lymph vessels 4.3.4 functions of lymph 4.3.5 Lymphoid organs. 4.4 Immunity and immune systems 4.4.1 Immunology 4.4.2 Innate (Non- specific) 4.4.3 Acquired immunity 4.4.4 Active immunity 4.4.5 Passive immunity 4.4.6 Cell mediated immunity 4.4.7 Antibody mediated immunity 4.5 Clonal Selection and Primary and Secondary immune responses 4.6 Immune disorders 4.7 Vaccinisation and Immunization (using traditional vaccines and recent technological vaccines).

5. Excretion. 5.1.1 Definition. 5.1.2 Different types of excretory organs in animals. 5.1.3 Skin, lungs and liver as excretory organs. 5.2 Nitrogenous excretion 5.2.1 Different types of Nitrogenous excretion with examples. 5.2.2. Ammenotelism, ureotelism and uricotelism. 5.3 Excretory system in Cockroch. 5.3.1 Excretory organs-Malphigian tubules and rectum. 5.3.2. Role of Malphigian tubules and rectum in excretion and osmoregulation. 5.4.Excretory system in man .5.4.1 Structure of kidney 5.4.2 Composition and formation of urine 5.4.3 Role of Kidney in osmoregulation 5.4.4 Hormonal regulation of excretory system. 5.4.5 Dialysis.

6. Locomotion and Movement. 6.1.1 Different modes of movement with examples 6.2.1 Human skeleton 6.2.2 Axial and appendicular skeleton. 6.3 Joints 6.3.1 Types of joints with examples 6.4 Bone and cartilage 6.4.1 Structure of Bone and Cartilage 6.4.2 Disordres of bone and cartilage (Arthritis and Osteoporoosis)

7. Muscles.7.1.1 Different types of muscles 7.1.2 Structure of skeletal muscle 7.1.3 Mechanism of muscle contraction 7.1.4 Role of red and white muscles in movement.7.1.5 Role of muscles and bones in movement.

8. Nervous Co-ordination 8.1 Nervous system in cockroach 8.1.1 Morphology of nervous system in cockroach 8.2. Human nervous system 8.2.1 Morphology of functional subsystems of nervous system. 8.2.2 Different types of nerve cells. 8.3 Structure and functions of brain and spinal cord. 8.4 Nerve impulse. 8.4.1 Synapse 8.4.2 Transmission and conduction of nerve impulse 8.5 Reflex action. 8.5.1 Reflex arc 8.6. Sensory receptors. 8.6.1 Structure and functions of eye, ear, nose, tongue and skin.

9. Hormones 9.1 Different types of hormones 9.2 Hormones produced by human endocrine glands and their functions. 9.3 Hormone imbalance and disorders 9.4 Role of hormones as messengers and regulators. 9.5 Feed back control of various hormones.

UNIT 15 - REPRODUCTION AND DEVELOPMENT IN ANIMALS

1. Reproduction 1.1 Asexual Reproduction. 1.1.1 Different types of asexual reproduction with examples 1.1.2 Sexual reproduction 1.2.1Conjugation,hermaphroditismand parthenogenesis with examples.

1.3 Reproductive organs. 1.3.1 Structure and function of human male and female reproductive system. 1.3.2 Reproductive cycle in human female 1.3.3 Gametogenesis 1.3.4 fertilization (Physical and chemical events) 1.3.5 Development of zygote up to 3 germinal layers and their derivatives.

1.4 Extra embryonic membranes.1.4.1 Structure and functions of placenta

1.5. Growth 1.5.1 Definition 1.5.2 Embryonic, post embryonic and cellular growth. 1.5.3 Types of growth and growth curve 1.5.4. Hormonal control of growth.

1.6 Ageing: 1.6.1 Definition.1.6.2 Life span and life expectancy 1.6.3. Ageing of human organs. 1.6.4 Process of ageing and theories related to ageing 1.6.5. Ageing and death.

1.7 Regeneration 1.7.1 Definition 1.7.2 Regeneration among animals 1.7.3 Types of regeneration. 1.7.4 Factors controlling amphibian limb regeneration.

UNIT 16 -BIODIVERSITY AND CONSERVATION

1. Biotic resources. 1.1 Terrestrial biotic resources. 1.1.1 forests 1.1.2 Grassland 1.1.3 wild life 1.1.4. Domesticated animals.

1.2 Aquatic biotic resources.1.2.1 Marine biotic resources (animal resources) 1.2.2 fresh water biotic resources.

2. Biodiversity 2.1.1 Definition 2.1.2 Significance of biodiversity 2.1.3 Magnitude of biodiversity 2.1.4 Levels of biodiversity 2.1.5 gradients of biodiversity 2.1.6 Uses of biodiversity 2.1.7 Threats of biodiversity.

3. Endangered species 3.1.1 Extinction 3.1.2 Causes of extinction.

4. Conservation of biodiversity 4.1.1 Biosphere reserves 4.1.2 protected ares 4.1.3 National and international efforts 4.1.4 Role of Government and non-government organizations in conservation of bio-diversity 4.1.5 Environmental ethics 4.1.6 Legislation to conserve biodiversity 4.1.7 Responsibility of individual in biodiversity conservation.

UNIT 17 - BIOLOGY IN HUMAN WELFARE

1. Population. 1.1.1 Role of environment in population 1.1.2 Role of development in population.

2. Population Growth. 2.1.1 Characteristics of population growth 2.1.2 Factors affecting population growth - Natality, Mortality, Immigration, Age and Sex ratio 2.1.3 Impact of Population growth.

3. Common problems of adolescence 3.1.1 Social and moral implications 3.1.2 Problems associated with drugs, smoking and alcoholism.

4. Population as a resource. 4.1.1 Generation of useful products and services- Intellectual, social, economic and political resources. 4.1.2 Conservation of existing resources.

5. Organ transplantation. 5.1.1. Transplantation of Skin, Kidney, Heart, Liver, Lungs, Cornea, Bone marrow, Blood and Pancreas

6. Modern techniques in disease diagnosis.6.1 AIDS and SCID. 6.1.1 Causes 6.1.2 Diagnosis-ELISA, WESTERN BLOT 6.1.3 Treatment. 6.2.1 STD -different types of STD 6.2.2. Causative agents 6.2.3 Diagnosis-Microscopic examination, Gram-staining of discharge, antigen/antibody detection, Culture, DNA hybridization, PCR 6.2.4 Treatment 6.3 Cancer 6.3.1 Types of Cancer 6.3.2 Various causes.6.3.3 Diagnosis-Blood test, Histopathology, CT Scan, MRI Scan, X-ray (using injected dyes) 6.3.4 Treatment.

7. Biotechnology.7.1.1. Hormones produced using biotechnology. 7.2. Hormone therapy 7.2.1 Hormone blocking and hormone –Supplementing therapy.

8. Interferon. 8.1.1. Definition 8.1.2. Different types of interferon 8.1.3. Role of interferon in medical treatment

9. Immuno modulations. 9.1. Immunomodulators - different approaches.

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