

**Entrance Examination Syllabus for B Tech (Food Technology)**

# PHYSICS

## UNIT 1: PHYSICAL WORLD AND MEASUREMENT

S I units, Fundamental and derived units. Accuracy and precision of measuring instruments, Errors in measurement, Significant figures. Dimensions of Physical quantities, dimensional analysis and its applications.

## UNIT 2: KINEMATICS

Motion in a straight line: Position-time graph, speed and velocity. Elementary concepts of differentiation and integration for describing motion. Uniform and non-uniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocity-time graph, position-time graphs, relations for uniformly accelerated motion, (graphical treatment and calculus approach). Scalar and Vector quantities, addition and Subtraction of vectors, general Vector and notation, Relativen Velocity. Scalar and Vector products of two vectors with properties, Unit Vector, Resolution of a Vector in plane rectangular components, Motion in a plane, Projectile Motion.

## UNIT 3: LAWS OF MOTION

Concept of force and Inertia, Newton's First Law of motion; Momentum and Newton's Second Law of motion, Impulse; Newton's Third Law of motion. Law of conversation of linear momentum and its applications, Equilibrium of concurrent forces. Friction, static and kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: Centripetal force and examples of circular motion (vehicle on level circular road, vehicle on banked road.)

## UNIT 4: WORK, ENERGY AND POWER

Concept of scalar products of vectors, Work done by a constant force and variable force; kinetic energy, work energy theorem, power. Potential energy, Potential energy of spring, conservative forces, conservation of mechanical energy (K.E. and P.E.), non-conservative forces; Elastic and inelastic collisions in one and two dimensions.

## UNIT 5: MOTION OF SYSTEM OF PARTICLES AND RIGID BODY

Centre of mass of a two-particle system, Centre of mass of a rigid body; Concepts of vector product of vectors: moment of a force, torque, angular momentum, conservation of angular momentum with some examples. Moment of inertia, radius of gyration. Values of moment of inertia for simple geometric objects (no derivation), statement of parallel and perpendicular axes theorems and their applications. Rigid body rotation and equations of rotational motion.

## UNIT 6: GRAVITATION

The universal law of gravitation. Acceleration due to gravity and its variation with altitude, depth and shape, Kepler's laws of planetary motion. Gravitational potential; gravitational potential energy. Escape velocity. Orbital velocity of satellite. Geostationary satellites.

### **UNIT 7: PROPERTIES OF BULK MATTER**

Elastic behavior, Stress-strain relationship. Hooke's Law, Young's modulus, bulk modulus, shear modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes) Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, Reynolds number. Bernoulli's theorem and its applications Surface energy and surface tension, angle of contact, applications of surface tension – ideas to drops, bubbles and capillary rise. Heat, temperature, thermal expansion; specific heat, calorimetry; change of state-latent heat. Heat transfer-conduction, convection and radiation, Newton's law of cooling.

### **UNIT 8: THERMODYNAMICS**

Thermal equilibrium and definition of temperature (zeroth law of thermodynamics),. Heat work and internal energy. First law of thermodynamics. Second law of thermodynamics: reversible and irreversible processes. Heat engines and refrigerators (concept only)

### **UNIT 9: BEHAVIOUR OF PERFECT GAS AND KINETIC THEORY**

Equation of state of a perfect gas, work done on compressing a gas. Kinetic theory of gases – assumptions, concept of pressure. Kinetic energy and temperature: rms speed of gas molecules; Degrees of freedom, Law of equipartition of energy (Statement only) and applications to specific heat capacities of gases; concept of Mean free path, Avagadro's number.

### **UNIT 10: OSCILLATIONS AND WAVES**

Periodic motion – Period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (S.H.M.) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in S.H.M. – kinetic and potential energies; Simple pendulum-derivation of expression for its time period; Free, forced and damped oscillations, resonance. Wave motion. Longitudinal and transverse waves, speed of a wave. Displacement relation for a progressive wave. Principle of superposition of waves, reflection of waves, Standing waves in strings and organ pipes, fundamental mode and harmonics, Beats, Doppler effect.

### **UNIT 11: ELECTROSTATICS**

Electric charges: Conservation of charge, Coulomb's law-forces between two point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electric field: Electric field due to a point charge, Electric field lines, Electric dipole, Electric field due to a dipole, Torque on a dipole in uniform electric field. Electric flux, Statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell (field inside and outside). Electric potential, electric potential due to a point charge, a dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field. Conductors and insulators, Dielectrics and electric polarization, capacitor and capacitance, combination of capacitors in series and in parallel, capacitance of parallel plate capacitor with and without dielectric medium between the plates, Energy stored in a capacitor. Van de Graff generator.

## **UNIT 12: CURRENT ELECTRICITY**

Electric current, Drift velocity, Ohm's law, Electrical resistance, V-I characteristics (linear & non-linear), Electrical energy and power, Electrical resistivity and conductivity, Carbon resistors, Colour code for carbon resistors; Temperature dependence of resistance. Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel.

Kirchhoff's laws and their applications. Wheatstone bridge, Metre bridge. Potentiometer – principle and its application to measure the potential difference and for comparing e.m.f. of two cells; measurement of internal resistance of a cell.

## **UNIT 13: MAGNETIC EFFECTS OF CURRENT AND MAGNETISM**

Biot – Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long current carrying straight wire, straight and toroidal solenoids. Force on moving charge in uniform magnetic and electric fields. Cyclotron. Force on a current-carrying conductor in a uniform magnetic field. Force between two parallel current-carrying conductors-definition of ampere. Torque experienced by a current loop in uniform magnetic field; Moving coil galvanometer, its current sensitivity and conversion with examples. Current loop as a magnetic dipole and its magnetic dipole moment, magnetic field lines; Earth's magnetic field and magnetic elements. Para-, dia- and ferro-magnetic substances with examples. Electromagnets and factors affecting their strength, permanent magnets.

## **UNIT 14: ELECTROMAGNETIC INDUCTION AND ALT. CURRENTS**

Electromagnetic induction: Faraday's law, induced emf and current; Lenz's Law. Eddy currents. Self and mutual inductance. Alternating currents, peak and rms value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only) & LCR circuits series, resonance; power in AC circuits, wattles current. AC generators and transformer.

## **UNIT 15: ELECTROMAGNETIC WAVES**

Electromagnetic waves and their characteristics. Transverse nature of electromagnetic waves. Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, Xrays, gamma rays) including elementary facts about their uses.

## **UNIT 16: OPTICS**

Ray optics-Reflection of light, spherical mirrors, mirror formula, refraction of light-Total internal reflection and its applications, Refraction at spherical surfaces, lenses, thin lens formula, Lens-makers Formula, Magnification, Power of a Lens. Combination of thin lenses in contact, Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers. Wave optics: wave front and Huygens' principle, reflection and refraction of plane wave at a plane surface using wave fronts. Proofs of laws of reflection and refraction using Huygen's principle. Interferences, 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. Resolving power of microscopes and astronomical telescopes, Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroid's.

## **UNIT 17: DUAL NATURE OF MATTER AND RADIATION**

Dual nature of radiation. Photoelectric effect, Hertz and Lenard's observations; Einstein's photoelectric equation; particle nature of light. Matter waves-wave nature of particle, de Broglie relation. Davission-Germer experiment.

### **UNIT 18: ATOMS AND NUCLEI**

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr's model of atom, energy levels, hydrogen spectrum. Composition and size of nucleus, atomic masses, isotopes, isobars; isotones. Radioactivity-alpha, beta and gamma particles/rays and their properties; radioactive decay law. Mass-energy relation, mass defect; binding energy per nucleon and its variation with mass number, nuclear fission and fusion.

### **UNIT 19: ELECTRONIC DEVICES**

Quantitative ideas on Energy bands in solids, conductors, insulators and semiconductors. Semiconductors; Semiconductor diode: I-V characteristics in forward and reverse bias; diode as a rectifier; I-V characteristics of LED, photodiode, solar cell and Zener diode; Zener diode as a voltage regulator. Junction transistor and its action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT) concept of NAND and NOR gates. Transistor as a switch.

### **UNIT 20: COMMUNICATION SYSTEM**

Basic elements of communication system (block diagram only), Bandwidth of signals (speech, TV and digital data); Bandwidth of Transmission medium, Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation. Need for modulation: Production and detection of an amplitude modulated wave.

# CHEMISTRY

## UNIT 1: CHEMICAL ARITHMETIC & ATOMIC STRUCTURE

Laws of chemical combination, Mole concept (numericals) Percentage composition, Chemical reactions, Stoichiometry and calculations based on stoichiometry. Atomic structure:- Bohr's model of Hydrogen atom, Quantum numbers, Pauli's exclusion principle, Hund's rule and Aufbau principle. Heisenberg's uncertainty principle, de-Broglie wave equation and its significance.

## UNIT 2: CHEMICAL EQUILIBRIUM

Law of mass action, Le-Chatelier's principle, and its application to physical and chemical equilibria. Ionisation of weak electrolytes (Ostwald's dilution law) Acids and bases: Acid base equilibria. Bronsted-Lowry and Lewis concept, of acids and bases. Ionic product of water. pH and pOH scales, pKa & pKb values, Solubility product, Buffer solutions Common ion effect, Hydrolysis of salts

## UNIT 3: CHEMICAL KINETICS

Rate of chemical reaction, Average and instantaneous rate, Factors effecting rate of reaction, Order and molecularity of reaction, Integrated rate equation and Half-life period (for zero and first order) reaction, Activation energy and Arrhenius equation.

## UNIT 4: SOLUTIONS

Vapour pressure, Raoult's law, Ideal and Non-ideal solutions, Colligative properties. Determination of molecular mass of non-volatile solutes through colligative properties. Abnormal molecular masses and Van't Hoff Factor.

## UNIT 5: CHEMICAL THERMODYNAMICS

Energy changes taking place during chemical reactions, Internal Energy and Enthalpy changes, Enthalpy of combustion, Solution and Neutralization. Hess's Law (Numerical problems) Laws of thermodynamics-first, second & third, Concepts of Entropy and Free energy, Spontaneity of a chemical reaction and Thermodynamic equilibrium.

## UNIT 6: REDOX REACTIONS AND ELECTROCHEMISTRY

Dependence of electrode and cell potential on concentration (Nernst Equation), Electrode potential as a criteria for product formation in electrolysis. E.M.F. of Galvanic cell, Relationship between free energy change and E.M.F. of a cell. Definition and units of Equivalent, Molar and Specific conductivity.

## UNIT 7: SOLID STATE & STATES OF MATTER

Boyle's Law, Charle's law, Dalton's law of partial pressure, Graham's law of diffusion of gases. Causes of deviation from ideal behaviour, ideal gas equation and nature of  $\alpha_R$ , Vander Waal's equation, surface tension and viscosity of liquids. Crystalline and amorphous solids, Crystal lattice, Crystal types, Packing efficiency, calculation of density of unit cell, Number of atoms per unit cell in a cubic cell. Co-ordination number, Stoichiometric defects: Schottky, Frenkel and interstitial. Properties of solids: Electrical, Magnetic & Dielectric.

## **UNIT 8: SURFACE CHEMISTRY**

Freundlich Adsorption isotherm, preparation of colloidal solutions by physical and chemical method. Electrical properties (cataphoresis, electroosmosis, coagulation and protective colloids) Homogeneous and Heterogeneous Catalysis.

## **UNIT 9: PERIODIC PROPERTIES**

Classification of elements as s, p, d, and f block elements. Variation of Ionization energy, Electron affinity, Electronegativity, Atomic and Ionic radii along the period and down the group in the periodic table.

## **UNIT 10: CHEMICAL BONDING AND MOLECULAR STRUCTURE**

Types of chemical bonds, Ionic & covalent bonds, Bond parameters, Quantum theory of covalent bond, pi and sigma bonds, Hybridization involving s, p and d-orbitals, Dipole moments and hydrogen bond. VSEPR: Shapes of simple molecules ( H<sub>2</sub>O, NH<sub>3</sub>, SO<sub>2</sub>, CO<sub>2</sub>, PCl<sub>3</sub>, PCl<sub>5</sub>, ClF<sub>3</sub>, BF<sub>3</sub>, SF<sub>4</sub>, XeF<sub>2</sub>, XeF<sub>4</sub> ). Molecular orbital theory: Energy Levels and M.O. diagrams of H<sub>2</sub>, H<sub>2</sub><sup>+</sup>, He<sub>2</sub>, O<sub>2</sub>, O<sub>1-2</sub>, O<sub>2-2</sub> & F<sub>2</sub>. Bond order and its significance.

## **UNIT 11: CHEMISTRY OF REPRESENTATIVE ELEMENTS**

S and P Block Elements: Electron configuration, Oxidation states and trends in various properties like ionization energy, electron affinity, atomic radii, electronegativity and diagonal relationship. Alkali metals: Hydration of ions, action with ammonia, flame colouration, solubility of hydroxides, carbonates and sulphates. Alkaline Earth Metals: Solubility of carbonates, hydroxides and sulphates. Boron Family: Structure of halides, relative acid strength of trihalides of boron. Carbon family: Hydrides and oxides. Nitrogen family: Oxides of Nitrogen and Phosphorous, reducing nature, basic strength and boiling points of their halides. Oxygen family: volatility, thermal stability, acid character, reducing character and bond angles of their hydrides, oxyacids of sulphur. Halogen family: Bond energy, colour and oxidizing power, boiling point, acid strength and dipole moment, thermal stability, reducing power of hydrides, relative acidity and oxidizing power of oxyacids of halogens.

## **UNIT 12: TRANSITION ELEMENTS INCLUDING LANTHANOIDS**

Electron configuration, Oxidation states, Colour, and Magnetic properties. Oxides of Vanadium, Chromium and Manganese Alloys of Copper, Silver and Iron. Metallurgy of Iron, Copper and Zinc.

## **UNIT 13: CO-ORDINATION CHEMISTRY**

Introduction, Ligands, Co-ordination Number, IUPAC Nomenclature. Bonding theories: Werner's, VBT and CFT. Isomerism in Co-ordination compounds (Ionization, Linkage, Hydrate, Geometrical and Optical). Applications of Co-ordination complexes in Biology, Medicine and Analytical Chemistry.

## **UNIT 14: NOMENCLATURE AND BASIC CONCEPTS IN ORGANIC CHEMISTRY**

Nomenclature of organic compounds (monofunctional and polyfunctional groups), inductive, electromeric resonance and hyperconjugation effects, reaction intermediates, carbocations, carbanions and free radicals with their general stability order, types of organic reactions (addition, substitution, elimination and redox reactions), aromaticity on the basis of Huckel rule. Ortho, meta and para directing groups.

## **UNIT 15: HYDROCARBONS**

Structural isomerism in alkanes, alkenes, alkynes and arenes, stereoisomerism: geometrical and optical isomerism, chirality, origin of chirality, specific rotation, racemisation and resolution, conformations in ethane and cyclohexane, relative configuration (D,L-Nomenclature), absolute (R and S system of nomenclature).

## **UNIT 16: ORGANIC CHEMISTRY BASED ON FUNCTIONAL GROUP-I**

Haloalkanes, haloarenes, alcohols and phenols: General methods of preparation and properties. Chloroform and Iodoform.

## **UNIT 17: ORGANIC CHEMISTRY BASED ON FUNCTION GROUP-II**

Ethers, Aldehydes, Ketones, Monocarboxylic acids: General methods of preparation and properties. Derivatives of monocarboxylic acids like acid halides, acid anhydrides acid amides and esters. Relative strength of carboxylic acids

## **UNIT 18: ORGANIC CHEMISTRY BASED ON FUNCTIONAL GROUP-III**

Cyanides, Isocyanides, Nitrocompounds and Amines: General methods of preparation and properties. Relative basic character of amines.

## **UNIT 19: MOLECULES OF LIFE**

Carbohydrates: Definition, Classification, Mutarotation, Structure of Amino-acids, Peptides and Proteins (Molish and ninhydrin tests). Classification and uses of vitamins. Chemicals in medicine and health care, Dyes and drugs. Chemical reactions in atmosphere, ozone depletion and its effects. Acid rain, Green House effect & Global warming.

## **UNIT 20: POLYMERS**

Introduction, Classification, Methods of Polymerisation (Addition, Condensation, Free Radical, Cationic & Anionic). Natural & Synthetic Polymers: Polythene, Nylon, Polyester, Bakelite and Rubber. Biodegradable and Non-Biodegradable Polymers.

# BIOLOGY

## UNIT-1: DIVERSITY AND CLASSIFICATION OF PLANTS

Systematics—need and history; Salient features of two and five kingdom systems and their merits and demerits; types of classifications (artificial, natural and phylogenetic); General characters of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms; Status of some acellular organisms like viruses and viroids;; Lichens---basic characteristics. Botanical gardens and herbarium.

## UNIT-2: MORPHOLOGY AND ANATOMY OF PLANTS

Morphology of root, stem and leaf and their modifications; types of inflorescence, flower, fruit and seed. Description of Liliaceae, Fabaceae and Solanaceae. Tissues and tissue system: Types of tissues (meristematic and permanent). Anatomy of dicot and monocot root, stem and leaves; secondary growth.

## UNIT-3: PLANT PHYSIOLOGY

Transport in plants: Mechanisms of transport—diffusion, facilitated diffusion, passive and active transport, antiport and symport. Plant water relations: Water potential; osmosis; plasmolysis; imbibition; long distance transport of water; apoplast, symplast pathways; ascent of sap; root pressure theory, tanspirational pull theory and cohesion-tension theory. Transpiration: mechanism of opening and closing of stomata, guttation; phloem transport (Mass Flow hypothesis), diffusion of gases. Mineral Nutrition: Essential Minerals; macro and micro nutrients—their role and deficiency symptoms and mineral toxicity. Mechanism of nutrient uptake by plants from soil. Hydroponics. Nitrogen metabolism—nitrogen cycle, nitrogen fixation. Photosynthesis: site of photosynthesis; various photosynthetic pigments; mechanism of light reaction; photophosphorylation (cyclic and non-cyclic); Dark reaction-fixation of carbon dioxide (C3 cycle, C4 cycle); factors affecting photosynthesis; photorespiration. Respiration: Exchange of gases, cellular respiration; glycolysis, Krebs cycle, Electron Transport System; Aerobic and anaerobic respiration; respiratory quotient. Growth and Development: Characteristics and phases of plant growth; growth curve; differentiation, dedifferentiation and redifferentiation; plant growth regulators-discovery, nature and physiological effects of auxins, gibberellins, cytokinins, ethylene and abscisic acid. Photoperiodism and vernalisation.

## UNIT-4: REPRODUCTION IN FLOWERING PLANTS

Modes of reproduction in flowering plants (Vegetative, asexual, sexual and micropropagation); development of male and female gametophytes; Pollination—types, agencies and examples; in-breeding and out-breeding devices, pollen-pistil interaction; double fertilization; post-fertilization events; development of endosperm, embryo, seed and fruit; apomixis and polyembryony—types and importance.

## UNIT-5: GENETICS

Heredity and variation (somatic and germinal); Mendel's laws of inheritance; deviations from Mendelism; incomplete dominance; co-dominance; multiple alleles; pleiotropy; Polygenic Inheritance; Chromosomal Theory of Inheritance. Evidence for DNA as genetic material; structure of DNA and RNA; DNA packaging; DNA replication; Protein synthesis— transcription, translation, genetic code; gene expression and regulation (lac-operon).



## **UNIT-6: ECOLOGY AND ENVIRONMENT**

Meaning of ecology, community, niche. Population and ecological adaptations: Characteristics of populations natality, fecundity & mortality, age distribution; population interactions, competition, predation, parasitism and mutualism. Ecosystems: Biotic and abiotic components; energy flow, nutrient cycling (carbon and phosphorus), decomposition and primary productivity; pyramids of number, biomass and energy; ecological succession types. Food chain and food web. Biodiversity and its conservation: threats to biodiversity; megabiodiversity countries and biodiversity hotspots; IUCN threat categories; in situ and ex situ methods of biodiversity conservation. Environmental issues: Causes and consequences of air and water pollution and their control; solid waste management; agrochemicals and their effect; greenhouse effect and global warming; stratospheric ozone layer depletion—causes and consequences.

## **UNIT- 7: BIOLOGY AND HUMAN WELFARE**

Plant breeding: Introduction, steps in plant breeding and application of plant breeding; Biofortification, Tissue culture: Cellular totipotency; technique and application of tissue culture Microbes in human welfare: Role of microbes in food processing; industrial production; sewage treatment; energy production (biogas); biopesticides and biofertilizers . Genetically Modified Organisms (GMOs); Bt crops, biopiracy and patents.

## **UNIT-8: DIVERSITY IN THE LIVING WORLD**

Characteristic features of living organisms Salient features of different animal phyla (non-chordates upto phylum level, chordates upto class level) National parks of India with special reference to J&K State:- Dachigam National Park, Hemis High altitude National park and Kishtwar High altitude National park.

## **UNIT-9: HISTOLOGY & MORPHOLOGY**

Animal Tissues:- Epithelial, Connective, Muscular and Nervous. Elementary knowledge on morphology & anatomy of Frog, Earthworm and Cockroach.

## **UNIT-10: CELL-STRUCTURE & FUNCTION**

Modern cell theory, Prokaryotic and eukaryotic cells, cell wall, cell membrane :- structure & function (fluid mosaic model). Cell organelles (Plastids, Mitochondria, Endoplasmic reticulum, Golgi bodies/ dictyosomes, Ribosomes, Lysosomes, Nucleus, Vacuoles, Centrioles, cilia & Flagella) **Cell division:** Cell cycle, Mitosis and Meiosis **Bio molecules:** Structure and function of carbohydrates, proteins, lipids and nucleic acids. Primary and secondary metabolites. Metabolism **Enzymes:** Types, properties functions and factors controlling enzyme activity.

## **UNIT-11: HUMAN PHYSIOLOGY**

**(Marks: 08)**

Alimentary canal, digestion and absorption of food, disorders of digestive system (jaundice, vomiting, diarrhea, constipation, indigestion etc.) Respiratory organs, mechanism of breathing, respiratory volumes and capacities, transport of gases (oxygen and carbon dioxide), disorders of respiratory system (asthma, emphysema, fibrosis etc.) Circulatory system:- Blood & lymph and their functions, blood groups, coagulation of blood, human heart, cardiac cycle, ECG, double circulation, disorders of circulatory system. (hypertension, coronary artery disease, angina, heart failure). Excretory products and their elimination. Modes of Excretion; Ammonotelism, Ureotelism and Uricotelism. Human excretory system, urine formation, functions of tubules, mechanism of concentration of the filtrate, regulation of kidney function, micturition, role of other organs in

excretion (lungs, liver and skin), haemodialysis and peritoneal dialysis, disorders of the excretory system (kidney failure, glomerulonephritis, renal calculi) Types of movement (amoeboid, ciliary and muscular), different types of muscles, structure of contractile proteins (actin and myosin), mechanism of muscle contraction, joints, disorders of muscular and skeletal system (Myasthenia gravis, muscular dystrophy, tetany, arthritis, gout, osteoporosis) Human nervous system, neuron as a structural and functional unit of nervous system, generation and conduction of nerve impulse, transmission of impulses, reflex action and reflex arc, structure and functioning of the sense organs (eye and ear) Endocrine glands, Mechanism of hormone action, hormones of heart, kidney and gastrointestinal tract.

## **UNIT-12: REPRODUCTION**

Asexual reproduction:- Characteristics and types of asexual reproduction (binary fission, sporulation, budding, gemmules, fragmentation, regeneration). Human reproduction:- male and female reproductive system, microscopic anatomy of testis and ovary, spermatogenesis and oogenesis, menstrual cycle, fertilization, embryo development upto blastocyst formation, implantation, pregnancy and placenta formation, parturition and lactation Reproductive health:- need for reproductive health, sexually transmitted diseases and their control and prevention. Birth control :- its need and methods, contraception and medical termination of pregnancy (MPT), amniocentesis, infertility and associated reproductive technologies (IVF,ZIFT,GIFT).

## **UNIT-13: GENETICS AND EVOLUTION**

Sex determination in humans, birds and honey bee. Inheritance pattern of Mendelian disorders in humans (colour blindness, haemophilia, cystic fibrosis, sickle- cell anaemia, phenylketonuria, thalassemia ) Chromosomal disorders in humans:- Down's syndrome, Turner's syndrome and Klinefelter's syndrome Genome and human genome project. DNA fingerprinting. Origin of life, theories and evidences for evolution with special reference to Darwinian theory, and Modern synthetic theory, Hardy-Weinberg principle, Adaptive radiation. Origin and evolution of man.

## **UNIT-14: BIOLOGY AND HUMAN WELFARE**

Health and Diseases:- basic concepts of immunology, vaccines, common diseases in human beings (their causative agents, symptoms, prevention and control) with reference to typhoid, hepatitis, malaria, filariasis, bubonic plague, ascariasis, common cold, amoebiasis and ring worm. Detailed account of diseases like cancer and HIV/ AIDS. Insects and human welfare:- Silk, honey and lac producing insects, their life- cycle and usefulness of their products. Poultry and Dairy Farming. Adolescence and drug and alcohol abuse (effects of drug/ alcohol abuse, prevention and control).

## **UNIT -15: BIOTECHNOLOGY AND ITS APPLICATIONS**

Genetic engineering (recombinant DNA technology), cloning. Biotechnological production of human insulin, vaccines and growth hormone. Gene therapy. Bio safety/ ethical issues regarding recombinant DNA technology.

## MATHEMATICS

**Sets** and their representation, finite and infinite sets, empty set subsets, subset of real numbers especially intervals, power set, universal set. Venn diagram, union and intersection of sets. Difference of sets, Compliment of a set. Ordered pairs, Cartesian product of sets, number of elements in the Cartesian product of two finite sets.

**Relations**, Domain, co- domain and range of relation, types of relations, reflexive, symmetric, transitive and equivalence relations.

**Functions** as special kind of relations from one set to another, domain, co-domain and range of a function. One to one, onto functions. Real valued functions of the real variable; constant, identity, polynomial, rational, modulus, signum and the greatest integer functions with their graphs. Sum, difference, product and quotients of functions. Composition of functions, inverse of a function, binary operations.

### UNIT 2: COMPLEX NUMBER; LINEAR INEQUATION; LINEAR PROGRAMMING

**Complex number**: Conjugate of a complex number, modulus and amplitude (argument) of a complex number, Argand's plane and polar representation of complex numbers, algebraic properties of complex numbers. Fundamental theorem of algebra, solution of Quadratic equation in the complex number system. Square root of a complex number.

**Linear inequation**: Algebraic solution of linear inequalities in one variable and two variables.

**Linear programming**: Introduction , definition of related terminology such as constraints, objective function, optimization, different type of linear programming problem (L.P), mathematical formulation of L.P problem, graphical method of solution for problems in two variables, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions.

### UNIT 3: SEQUENCE AND SERIES, PERMUTATION AND COMBINATION & BINOMIAL THEOREM

**Sequence and series**: Arithmetic progression (A.P), arithmetic mean (A.M), nth term, sum to n-terms of an A.P; Geometric progression (G.P) , Geometric Mean (G.M), nth term, sum to n-terms and sum to infinity of a G.P. Relation between A.M and G.M. Sum to n terms of

**Permutation and combination**: Fundamental principle of counting, factorial n, permutations  $P(n,r)$  and combinations  $C(n,r)$ , simple applications.

**Binomial Theorem**:. Binomial theorem for positive integral power. general and middle terms in the Binomial expansion. Pascal's triangle and simple applications.

## UNIT 4: TRIGONOMETRIC AND INVERSE TRIGONOMETRY FUNCTIONS

Positive and negative angles, measuring angles in radians and in degrees, Conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Periodicity of Trigonometric functions. Basic Trigonometric identities  $\sin^2x + \cos^2x = 1$  for all Sign of  $x$  etc. Trigonometric functions and their graphs. Expressions for  $\sin(x \pm y)$ ,  $\cos(x \pm y)$ ,  $\tan(x \pm y)$ ,  $\cot(x \pm y)$ , sum and product formulae.

Identities related to  $\sin 2x$ ,  $\cos 2x$ ,  $\tan 2x$ ,  $\sin 3x$ ,  $\cos 3x$ , and  $\tan 3x$ . General and principal solutions of trigonometric equations of the type  $\sin x = \sin a$ ,  $\cos x = \cos a$ ,  $\tan x = \tan a$ .

**Inverse trigonometric functions**, range, domain, principal value branches. Graphs of inverse trigonometric functions, elementary properties of inverse trigonometric functions

## UNIT 5: MATRICES AND DETERMINANTS

**Matrices**, concepts, notation, order, equality, types of matrices, Zero matrix, transpose of matrix, Symmetric and skew symmetric matrices. Addition, multiplication, scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication of matrices. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (order  $2 \times 2$ ). Concept of elementary row and column operation, Invertible matrices and uniqueness of inverse, if it exists. (Matrices with real entries).

**Determinants** of square matrix (upto  $3 \times 3$  matrices) properties of determinants, minors, cofactors and applications of determinants in finding area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables using inverse of a matrix.

## UNIT 6: LIMIT, CONTINUITY AND DIFFERENTIATION

Concept of limit of a function. Theorems on Limits, Evaluation of limits using standard results

$$\lim_{x \rightarrow 0} \frac{\sin x}{x}, \lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}, \lim_{x \rightarrow 0} \frac{1}{x}, \lim_{x \rightarrow \infty} \frac{1}{x}, \lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$$
$$\lim_{x \rightarrow 0} (1+x)^{1/x}, \lim_{x \rightarrow 0} \frac{\log(1+x)}{x}, \lim_{x \rightarrow 0} \frac{e^x - 1}{x},$$

**Continuity** of a function at a point. Continuity of Sum, product and quotient of functions. **Derivative**: definition of a derivative of a function, geometrical interpretation of the derivative.

- Derivative of sum, difference, product and quotient of two or more functions.
- Derivative of algebraic and composite functions.
- Derivative of trigonometric and inverse trigonometric functions.
- Chain rule, derivative of implicit functions.
- Derivative of logarithmic and exponential functions.
- Logarithmic differentiation.

- Derivative of functions expressed parametric forms. Second order derivatives.
- Rolle's and Lagrange's Mean Value Theorem and their geometrical interpretation and their simple applications.

**Application of Derivative:** rate of change, increasing and decreasing functions, tangents and normals, approximation, maxima and minima (first derivative and second derivative test). Simple problems.

## UNIT 7: INTEGRATION AND DIFFERENTIAL EQUATIONS

Integration as inverse process of differentiation. Integration of variety of functions by Substitution, by parts, by partial fractions. Simple integrals of the type:

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}},$$

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

$$\int \sqrt{a^2 \pm x^2} \cdot dx, \int \sqrt{x^2 - a^2} \cdot dx,$$

$$\int \sqrt{ax^2 + bx + c} dx, \int \frac{dx}{a + b \cos x}, \int \frac{dx}{a + b \sin x},$$

$$\int (px + q)\sqrt{ax^2 + bx + c} dx$$

Definite integrals as a Limit of a sum. Fundamental Theorem of calculus. Basic properties of definite integrals Evaluation of definite integrals.

**Application of integrals:** Application in finding the area under simple curves, especially lines. Areas of circles, parabolas and ellipses (in standard form) Area under the curve  $y = \sin x$ ,  $y = \cos x$ , area between the above two curves.

**Differential Equations:** Definition, order and degree of a differential equation. General and particular solutions of a differential equation. Formation of a differential equation whose general solution is given. Solution of differentiation equation by method of separation of variables. Solution of Homogeneous differential equation of first order and first degree. Solution of linear differential equation of the type:

$$\frac{dy}{dx} + py = q, \text{ where } p \text{ and } q \text{ are functions of } x \text{ alone and}$$

$$\frac{dx}{dy} + px = q, \text{ where } p \text{ and } q \text{ are functions of } y \text{ alone.}$$

## **UNIT 8: STRAIGHT LINES AND CONIC SECTIONS**

Distance between two points, section, slope of a line, angle between two lines, various forms of equations of lines, point-slope form, intercept form, two point form, and normal form. General equation of a line, distance of a point from a line. Conic Section: Sections of a cone, circles, parabola, ellipse, hyperbola, a point, a straight line and a pair of intersecting lines as a degenerated case of conic section. Standard equation of a circle, parabola, ellipse, and hyperbola and their simple properties.

## **UNIT 9: STATISTICS AND PROBABILITY**

**STATISTICS** Measure of dispersion, mean, deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distribution with equal means but different variances.

**PROBABILITY** : Random Experiment: outcome, sample spaces.

Events: Mutually exclusive and exhaustive events. Axiomatic (set theoretic) probability, probability of an event, probability of

“Not” and “Or” events. Multiplication theorem on probability, conditional probability, independent events, total probability, Baye’s theorem, random variable and its probability, distribution, mean and variance of a random variable. Repeated independent (Bernouli) trials and Binomial distribution.

## **UNIT 10: VECTORS AND THREE DIMENSIONAL GEOMETRY**

Vectors and scalars, magnitude and direction of a vector Direction Cosines and ratios of a vector. Types of vector, equal, zero, unit, parallel and collinear vectors. Position vector of a point , negative of a vector, components of a vector, addition of vectors, Scalar multiplication, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors, Scalar triple product. Coordinate axes and Coordinate planes in three dimensions of a point, distance between two points and sectional formula.

**STRAIGHT LINES AND SPACE** Direction cosines and direction ratios of a line joining two points. Cartesian and vector equation of a line (in various forms), coplanar and skew-lines, shortest distance between two lines.

**PLANES** Cartesian and vector equation of a plane ( in various forms). Distance of a point from a plane.

Angle between:

1. Two lines
2. Two planes.
3. A line and a plane