

# Syllabus for HPCET-2019 Entrance Examination

## APPENDIX-A

### HPCET-2019 Syllabus for B. Tech./ B. Pharmacy/B. Pharmacy (Ayurveda)

#### MATHEMATICS

##### **UNIT 1: SETS, RELATIONS AND FUNCTIONS:**

Sets and their representation; Union, intersection and complement of sets and their algebraic properties; Power set; Relation, Types of relations, equivalence relations, functions; one-one, into and onto functions, composition of functions.

##### **UNIT 2: COMPLEX NUMBERS AND QUADRATIC EQUATIONS:**

Complex numbers as ordered pairs of reals, Representation of complex numbers in the form  $a+ib$  and their representation in a plane, Argand diagram, algebra of complex numbers, modulus and argument (or amplitude) of a complex number, square root of a complex number, triangle inequality, Quadratic equations in real and complex number system and their solutions. Relation between roots and co-efficients, nature of roots, formation of quadratic equations with given roots.

##### **UNIT 3: MATRICES AND DETERMINANTS:**

Matrices, algebra of matrices, types of matrices, determinants and matrices of order two and three. Properties of determinants, evaluation of determinants, area of triangles using determinants. Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test of consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices.

##### **UNIT 4: PERMUTATIONS AND COMBINATIONS:**

Fundamental principle of counting, permutation as an arrangement and combination as selection, Meaning of  $P(n,r)$  and  $C(n,r)$ , simple applications.

##### **UNIT 5: MATHEMATICAL INDUCTION:**

Principle of Mathematical Induction and its simple applications.

##### **UNIT 6: BINOMIAL THEOREM AND ITS SIMPLE APPLICATIONS:**

Binomial theorem for a positive integral index, general term and middle term, properties of Binomial coefficients and simple applications.

##### **UNIT 7: SEQUENCES AND SERIES:**

Arithmetic and Geometric progressions, insertion of arithmetic, geometric means between two given numbers. Relation between A.M. and G.M. Sum upto  $n$  terms of special series:  $S_n$ ,  $S_{2n}$ ,  $S_{3n}$ . Arithmetic-Geometric progression.

##### **UNIT 8: LIMIT, CONTINUITY AND DIFFERENTIABILITY:**

Real - valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse functions. Graphs of simple functions. Limits, continuity and differentiability. Differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order upto two. Rolle's and Lagrange's Mean Value Theorems. Applications of derivatives: Rate of change of quantities, monotonic - increasing and decreasing functions, Maxima and minima of functions of one variable, tangents and normals.

##### **UNIT 9: INTEGRAL CALCULUS:**

Integral as an anti - derivative. Fundamental integrals involving algebraic, trigonometric, exponential and logarithmic functions. Integration by substitution, by parts and by partial fractions. Integration using trigonometric identities.

##### **Evaluation of simple integrals of the type**

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

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

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

Integral as limit of a sum. Fundamental Theorem of Calculus. Properties of definite integrals. Evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form.

##### **UNIT 10: DIFFERENTIAL EQUATIONS:**

Ordinary differential equations, their order and degree. Formation of differential equations. Solution of differential equations by the method of separation of variables, solution of homogeneous and linear differential equations of the type:

$$\frac{dy}{dx} + p(x)y = q(x)$$

##### **UNIT 11: CO-ORDINATE GEOMETRY:**

Cartesian system of rectangular co-ordinates in a plane, distance formula, section formula, locus and its equation, translation of axes, slope of a line, parallel and perpendicular lines, intercepts of a line on the coordinate axes.

## **Straight lines**

Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, distance of a point from a line, equations of internal and external bisectors of angles between two lines, coordinates of centroid, orthocentre and circumcentre of a triangle, equation of family of lines passing through the point of intersection of two lines.

## **Circles, conic sections**

Standard form of equation of a circle, general form of the equation of a circle, its radius and centre, equation of a circle when the end points of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to a circle, equation of the tangent. Sections of cones, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, condition for  $y = mx + c$  to be a tangent and point (s) of tangency.

### **UNIT 12: THREE DIMENSIONAL GEOMETRY:**

Coordinates of a point in space, distance between two points, section formula, direction ratios and direction cosines, angle between two intersecting lines. Skew lines, the shortest distance between them and its equation. Equations of a line and a plane in different forms, intersection of a line and a plane, coplanar lines.

### **UNIT 13: VECTOR ALGEBRA:**

Vectors and scalars, addition of vectors, components of a vector in two dimensions and three dimensional space, scalar and vector products, scalar and vector triple product.

### **UNIT 14: STATISTICS AND PROBABILITY:**

Measures of Dispersion: Calculation of mean, median, mode of grouped and ungrouped data calculation of standard deviation, variance and mean deviation for grouped and ungrouped data.

Probability: Probability of an event, addition and multiplication theorems of probability, Baye's theorem, probability distribution of a random variate, Bernoulli trials and Binomial distribution.

### **UNIT 15: TRIGONOMETRY:**

Trigonometrical identities and equations. Trigonometrical functions. Inverse trigonometrical functions and their properties. Heights and Distances.

### **UNIT 16: MATHEMATICAL REASONING:**

Statements, logical operations and, or, implies, implied by, if and only if. Understanding of tautology, contradiction, converse and contrapositive.

## **PHYSICS**

**The syllabus contains two Sections - A and B. Section - A pertains to the Theory Part having 80% weightage, while Section - B contains Practical Component (Experimental Skills) having 20% weightage.**

### **SECTION - A**

#### **UNIT 1: PHYSICS AND MEASUREMENT**

Physics, technology and society, S I units, Fundamental and derived units. Least count, accuracy and precision of measuring instruments, Errors in measurement, Dimensions of Physical quantities, dimensional analysis and its applications.

#### **UNIT 2: KINEMATICS**

Frame of reference. Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion. Scalars and Vectors, Vector addition and Subtraction, Zero Vector, Scalar and Vector products, Unit Vector, Resolution of a Vector. Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.

#### **UNIT 3: LAWS OF MOTION**

Force and Inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion; Impulse; Newton's Third Law of motion. Law of conservation of linear momentum and its applications, Equilibrium of concurrent forces.

Static and Kinetic friction, laws of friction, rolling friction.

Dynamics of uniform circular motion: Centripetal force and its applications.

#### **UNIT 4: WORK, ENERGY AND POWER**

Work done by a constant force and a variable force; kinetic and potential energies, work-energy theorem, power.

Potential energy of a spring, conservation of mechanical energy, conservative and nonconservative forces; Elastic and inelastic collisions in one and two dimensions.

#### **UNIT 5: ROTATIONAL MOTION**

Centre of mass of a two-particle system, Centre of mass of a rigid body; Basic concepts of rotational motion; moment of a force, torque, angular momentum, conservation of angular momentum and its applications; moment of inertia, radius of gyration. Values of moments of inertia for simple geometrical

objects, parallel and perpendicular axes theorems and their applications. Rigid body rotation, equations of rotational motion.

#### **UNIT 6: GRAVITATION**

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

#### **UNIT 7: PROPERTIES OF SOLIDS AND LIQUIDS**

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

#### **UNIT 8: THERMODYNAMICS**

Thermal equilibrium, zeroth law of thermodynamics, concept of temperature. Heat, work and internal energy. First law of thermodynamics. Second law of thermodynamics: reversible and irreversible processes. Carnot engine and its efficiency.

#### **UNIT 9: KINETIC THEORY OF GASES**

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, applications to specific heat capacities of gases; Mean free path, Avogadro'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 in sound

#### **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 a uniform electric field.

Electric flux, Gauss's law and its applications to find field due to infinitely long uniformly charged straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell. Electric potential and its calculation for a point charge, electric dipole and system of charges; Equipotential surfaces, Electrical potential energy of a system of two point charges in an electrostatic field.

Conductors and insulators, Dielectrics and electric polarization, capacitor, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, Energy stored in a capacitor.

#### **UNIT 12: CURRENT ELECTRICITY**

Electric current, Drift velocity, Ohm's law, Electrical resistance, Resistances of different materials, V-I characteristics of Ohmic and nonohmic conductors, Electrical energy and power, Electrical resistivity, Colour code for resistors; Series and parallel combinations of resistors; Temperature dependence of resistance.

Electric Cell and its Internal resistance, 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 applications.

#### **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 and solenoid. Force on a 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 to ammeter and voltmeter.

Current loop as a magnetic dipole and its magnetic dipole moment. Bar magnet as an equivalent solenoid, magnetic field lines; Earth's magnetic field and magnetic elements. Para-, dia- and ferro- magnetic substances.

Magnetic susceptibility and permeability, Hysteresis, Electromagnets and permanent magnets.

#### **UNIT 14: ELECTROMAGNETIC INDUCTION AND ALTERNATING 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; LCR series circuit, resonance; Quality factor, power in AC circuits, wattless current. AC generator 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). Applications of e.m. waves.

#### **UNIT 16: OPTICS**

Reflection and refraction of light at plane and spherical surfaces, mirror formula, Total internal reflection and its applications, Deviation and Dispersion of light by a prism, Lens Formula, Magnification, Power of a Lens, Combination of thin lenses in contact, Microscope and Astronomical Telescope (reflecting and refracting) and their magnifying powers.

Wave optics: wavefront and Huygens' principle, Laws of reflection and refraction using Huygen's principle. 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. Resolving power of microscopes and astronomical telescopes, Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroids.

#### **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. Davisson-Germer experiment.

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

Alpha-particle scattering experiment; Rutherford's model of atom; Bohr model, 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**

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, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR). Transistor as a switch.

#### **UNIT 20: COMMUNICATION SYSTEMS**

Propagation of electromagnetic waves in the atmosphere; Sky and space wave propagation, Need for modulation, Amplitude and Frequency Modulation, Bandwidth of signals, Bandwidth of Transmission medium, Basic Elements of a Communication System (Block Diagram only).

#### **SECTION -B**

#### **UNIT 21: EXPERIMENTAL SKILLS**

Familiarity with the basic approach and observations of the experiments and activities:

1. Vernier callipers-its use to measure internal and external diameter and depth of a vessel.
2. Screw gauge-its use to determine thickness/ diameter of thin sheet/wire.
3. Simple Pendulum-dissipation of energy by plotting a graph between square of amplitude and time.
4. Metre Scale - mass of a given object by principle of moments.
5. Young's modulus of elasticity of the material of a metallic wire.
6. Surface tension of water by capillary rise and effect of detergents.
7. Co-efficient of Viscosity of a given viscous liquid by measuring terminal velocity of a given spherical body.
8. Plotting a cooling curve for the relationship between the temperature of a hot body and time.
9. Speed of sound in air at room temperature using a resonance tube.
10. Specific heat capacity of a given (i) solid and (ii) liquid by method of mixtures.
11. Resistivity of the material of a given wire using metre bridge.
12. Resistance of a given wire using Ohm's law.
13. Potentiometer -
  - (i) Comparison of emf of two primary cells.
  - (ii) Determination of internal resistance of a cell.

14. Resistance and figure of merit of a galvanometer by half deflection method.
15. Focal length of:
  - (i) Convex mirror
  - (ii) Concave mirror, and
  - (iii) Convex lens
 using parallax method.
16. Plot of angle of deviation vs angle of incidence for a triangular prism.
17. Refractive index of a glass slab using a travelling microscope.
18. Characteristic curves of a p-n junction diode in forward and reverse bias.
19. Characteristic curves of a Zener diode and finding reverse break down voltage.
20. Characteristic curves of a transistor and finding current gain and voltage gain.
21. Identification of Diode, LED, Transistor, IC, Resistor, Capacitor from mixed collection of such items.
22. Using multimeter to:
  - (i) Identify base of a transistor
  - (ii) Distinguish between npn and pnp type transistor
  - (iii) See the unidirectional flow of current in case of a diode and an LED.
  - (iv) Check the correctness or otherwise of a given electronic component (diode, transistor or IC).

## CHEMISTRY

### SECTION: A

#### PHYSICAL CHEMISTRY

#### : SOME BASIC CONCEPTS IN CHEMISTRY

Matter and its nature, Dalton's atomic theory; Concept of atom, molecule, element and compound; Physical quantities and their measurements in Chemistry, precision and accuracy, significant figures, S.I. Units, dimensional analysis; Laws of chemical combination; Atomic and molecular masses, mole concept, molar mass, percentage composition, empirical and molecular formulae; Chemical equations and stoichiometry.

#### : STATES OF MATTER

Classification of matter into solid, liquid and gaseous states.

##### **Gaseous State:**

Measurable properties of gases; Gas laws - Boyle's law, Charles's law, Graham's law of diffusion, Avogadro's law, Dalton's law of partial pressure; Concept of

Absolute scale of temperature; Ideal gas equation; Kinetic theory of gases (only postulates); Concept of average, root mean square and most probable velocities; Real gases, deviation from Ideal behaviour, compressibility factor and van der Waals equation.

##### **Liquid State:**

Properties of liquids - vapour pressure, viscosity and surface tension and effect of temperature on them (qualitative treatment only).

##### **Solid State:**

Classification of solids: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea); Bragg's Law and its applications; Unit cell and lattices, packing in solids (fcc, bcc and hcp lattices), voids, calculations involving unit cell parameters, imperfection in solids; Electrical and magnetic properties.

#### UNIT 3: ATOMIC STRUCTURE

Thomson and Rutherford atomic models and their limitations; Nature of electromagnetic radiation, photoelectric effect; Spectrum of hydrogen atom, Bohr model of hydrogen atom - its postulates, derivation of the relations for energy of the electron and radii of the different orbits, limitations of Bohr's model; Dual nature of matter, de-Broglie's relationship, Heisenberg uncertainty principle. Elementary ideas of quantum mechanics, quantum mechanical model of atom, its important features. Concept of atomic orbitals as one electron wave functions; Variation of  $\psi$  and  $\psi^2$  with  $r$  for 1s and 2s orbitals; various quantum numbers (principal, angular momentum and magnetic quantum numbers) and their significance; shapes of s, p and d - orbitals, electron spin and spin quantum number; Rules for filling electrons in orbitals - aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of elements, extra stability of half-filled and completely filled orbitals.

#### UNIT 4: CHEMICAL BONDING AND MOLECULAR STRUCTURE

Kossel - Lewis approach to chemical bond formation, concept of ionic and covalent bonds.

**Ionic Bonding:** Formation of ionic bonds, factors affecting the formation of ionic bonds; calculation of lattice enthalpy.

**Covalent Bonding:** Concept of electronegativity, Fajan's rule, dipole moment; Valence Shell Electron Pair Repulsion (VSEPR) theory and shapes of simple molecules.

**Quantum mechanical approach to covalent bonding:** Valence bond theory - Its important features, concept

of hybridization involving s, p and d orbitals; Resonance.

**Molecular Orbital Theory** - Its important features, LCAOs, types of molecular orbitals (bonding, antibonding), sigma and pi-bonds, molecular orbital electronic configurations of homonuclear diatomic molecules, concept of bond order, bond length and bond energy.

Elementary idea of metallic bonding. Hydrogen bonding and its applications.

#### UNIT 5: CHEMICAL THERMODYNAMICS

Fundamentals of thermodynamics: System and surroundings, extensive and intensive properties, state functions, types of processes.

**First law of thermodynamics** - Concept of work, heat internal energy and enthalpy, heat capacity, molar heat capacity; Hess's law of constant heat summation; Enthalpies of bond dissociation, combustion, formation, atomization, sublimation, phase transition, hydration, ionization and solution.

**Second law of thermodynamics**; Spontaneity of processes;  $\Delta S$  of the universe and  $\Delta G$  of the system as criteria for spontaneity,  $\Delta G^\circ$  (Standard Gibbs energy change) and equilibrium constant.

#### UNIT 6: SOLUTIONS

Different methods for expressing concentration of solution - molality, molarity, mole fraction, percentage (by volume and mass both), vapour pressure of solutions and Raoult's Law - Ideal and non-ideal solutions, vapour pressure - composition, plots for ideal and non-ideal solutions; Colligative properties of dilute solutions - relative lowering of vapour pressure, depression of freezing point, elevation of boiling point and osmotic pressure; Determination of molecular mass using colligative properties; Abnormal value of molar mass, van't Hoff factor and its significance.

#### UNIT 7: EQUILIBRIUM

Meaning of equilibrium, concept of dynamic equilibrium.

**Equilibria involving physical processes**: Solid-liquid, liquid - gas and solid - gas equilibria, Henry's law, general characteristics of equilibrium involving physical processes.

**Equilibria involving chemical processes**: Law of chemical equilibrium, equilibrium constants ( $K_p$  and  $K_c$ ) and their significance, significance of  $\Delta G$  and  $\Delta G^\circ$  in chemical equilibria, factors affecting equilibrium concentration, pressure, temperature, effect of catalyst; Le Chatelier's principle.

**Ionic equilibrium**: Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius, Brønsted - Lowry and Lewis) and their ionization, acid - base equilibria (including multistage ionization) and ionization constants, ionization of water, pH scale, common ion effect, hydrolysis of salts and pH of their solutions, solubility of sparingly soluble salts and solubility products, buffer solutions.

#### UNIT 8: REDOX REACTIONS AND ELECTROCHEMISTRY

Electronic concepts of oxidation and reduction, redox reactions, oxidation number, rules for assigning oxidation number, balancing of redox reactions.

Electrolytic and metallic conduction, conductance in electrolytic solutions, molar conductivities and their variation with concentration: Kohlrausch's law and its applications.

Electrochemical cells - Electrolytic and Galvanic cells, different types of electrodes, electrode potentials including standard electrode potential, half - cell and cell reactions, emf of a Galvanic cell and its measurement; Nernst equation and its applications; Relationship between cell potential and Gibbs' energy change; Dry cell and lead accumulator; Fuel cells.

#### UNIT 9: CHEMICAL KINETICS

Rate of a chemical reaction, factors affecting the rate of reactions: concentration, temperature, pressure and catalyst; elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its units, differential and integral forms of zero and first order reactions, their characteristics and half - lives, effect of temperature on rate of reactions - Arrhenius theory, activation energy and its calculation, collision theory of bimolecular gaseous reactions (no derivation).

#### UNIT-10: SURFACE CHEMISTRY

**Adsorption**- Physisorption and chemisorption and their characteristics, factors affecting adsorption of gases on solids - Freundlich and Langmuir adsorption isotherms, adsorption from solutions.

Catalysis - Homogeneous and heterogeneous, activity and selectivity of solid catalysts, enzyme catalysis and its mechanism.

**Colloidal state**- distinction among true solutions, colloids and suspensions, classification of colloids - lyophilic, lyophobic; multimolecular, macromolecular and associated colloids (micelles), preparation and properties of colloids - Tyndall effect, Brownian movement, electrophoresis, dialysis, coagulation and flocculation; Emulsions and their characteristics.

## SECTION - B

### INORGANIC CHEMISTRY

#### UNIT 11: CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

Modern periodic law and present form of the periodic table, s, p, d and f block elements, periodic trends in properties of elements atomic and ionic radii, ionization enthalpy, electron gain enthalpy, valence, oxidation states and chemical reactivity.

#### UNIT 12: GENERAL PRINCIPLES AND PROCESSES OF ISOLATION OF METALS

Modes of occurrence of elements in nature, minerals, ores; Steps involved in the extraction of metals - concentration, reduction (chemical and electrolytic methods) and refining with special reference to the extraction of Al, Cu, Zn and Fe; Thermodynamic and electrochemical principles involved in the extraction of metals.

#### UNIT 13: HYDROGEN

Position of hydrogen in periodic table, isotopes, preparation, properties and uses of hydrogen; Physical and chemical properties of water and heavy water; Structure, preparation, reactions and uses of hydrogen peroxide; Classification of hydrides - ionic, covalent and interstitial; Hydrogen as a fuel.

#### UNIT 14: S - BLOCK ELEMENTS (ALKALI AND ALKALINE EARTH METALS)

Group - 1 and 2 Elements

General introduction, electronic configuration and general trends in physical and chemical properties of elements, anomalous properties of the first element of each group, diagonal relationships.

Preparation and properties of some important compounds - sodium carbonate and sodium hydroxide and sodium hydrogen carbonate; Industrial uses of lime, limestone, Plaster of Paris and cement; Biological significance of Na, K, Mg and Ca.

#### UNIT 15: P - BLOCK ELEMENTS

##### Group - 13 to Group 18 Elements

**General Introduction:** Electronic configuration and general trends in physical and chemical properties of elements across the periods and down the groups; unique behaviour of the first element in each group.

##### Groupwise study of the p - block elements

##### Group - 13

Preparation, properties and uses of boron and aluminium; Structure, properties and uses of borax, boric acid, diborane, boron trifluoride, aluminium chloride and alums.

##### Group - 14

Tendency for catenation; Structure, properties and uses of Allotropes and oxides of carbon, silicon tetrachloride, silicates, zeolites and silicones.

##### Group - 15

Properties and uses of nitrogen and phosphorus; Allotropic forms of phosphorus; Preparation, properties, structure and uses of ammonia, nitric acid, phosphine and phosphorus halides, ( $\text{PCl}_3$ ,  $\text{PCl}_5$ ); Structures of oxides and oxoacids of nitrogen and phosphorus.

##### Group - 16

Preparation, properties, structures and uses of ozone; Allotropic forms of sulphur; Preparation, properties, structures and uses of sulphuric acid (including its industrial preparation); Structures of oxoacids of sulphur.

##### Group - 17

Preparation, properties and uses of hydrochloric acid; Trends in the acidic nature of hydrogen halides; Structures of Interhalogen compounds and oxides and oxoacids of halogens.

##### Group - 18

Occurrence and uses of noble gases; Structures of fluorides and oxides of xenon.

#### UNIT 16: d - and f - BLOCK ELEMENTS

##### Transition Elements

General introduction, electronic configuration, occurrence and characteristics, general trends in properties of the first row transition elements - physical properties, ionization enthalpy, oxidation states, atomic radii, colour, catalytic behaviour, magnetic properties, complex formation, interstitial compounds, alloy formation; Preparation, properties and uses of  $\text{K}_2\text{Cr}_2\text{O}_7$  and  $\text{KMnO}_4$ .

##### Inner Transition Elements

**Lanthanoids** - Electronic configuration, oxidation states and lanthanoid contraction.

**Actinoids** - Electronic configuration and oxidation states.

#### UNIT 17: CO-ORDINATION COMPOUNDS

Introduction to co-ordination compounds, Werner's theory; ligands, co-ordination number, denticity, chelation; IUPAC nomenclature of mononuclear co-ordination compounds, isomerism; Bonding-Valence bond approach and basic ideas of Crystal field theory, colour and magnetic properties; Importance of co-ordination compounds (in qualitative analysis, extraction of metals and in biological systems).

## UNIT 18: ENVIRONMENTAL CHEMISTRY

**Environmental pollution** - Atmospheric, water and soil.

**Atmospheric pollution** - Tropospheric and Stratospheric

**Tropospheric pollutants - Gaseous pollutants:** Oxides of carbon, nitrogen and sulphur, hydrocarbons; their sources, harmful effects and prevention; Green house effect and Global warming; Acid rain;

**Particulate pollutants:** Smoke, dust, smog, fumes, mist; their sources, harmful effects and prevention.

**Stratospheric pollution-** Formation and breakdown of ozone, depletion of ozone layer - its mechanism and effects.

**Water Pollution** - Major pollutants such as, pathogens, organic wastes and chemical pollutants; their harmful effects and prevention.

**Soil pollution** - Major pollutants such as: Pesticides (insecticides, herbicides and fungicides), their harmful effects and prevention.

Strategies to control environmental pollution.

### SECTION-C

### ORGANIC CHEMISTRY

#### UNIT 19: PURIFICATION AND CHARACTERISATION OF ORGANIC COMPOUNDS

**Purification** - Crystallization, sublimation, distillation, differential extraction and chromatography - principles and their applications.

**Qualitative analysis** - Detection of nitrogen, sulphur, phosphorus and halogens.

**Quantitative analysis** (basic principles only) - Estimation of carbon, hydrogen, nitrogen, halogens, sulphur, phosphorus.

Calculations of empirical formulae and molecular formulae; Numerical problems in organic quantitative analysis.

#### UNIT 20: SOME BASIC PRINCIPLES OF ORGANIC CHEMISTRY

Tetravalency of carbon; Shapes of simple molecules - hybridization (s and p); Classification of organic compounds based on functional groups: and those containing halogens, oxygen, nitrogen and sulphur; Homologous series; Isomerism - structural and stereoisomerism.

#### Nomenclature (Trivial and IUPAC)

Covalent bond fission - Homolytic and heterolytic: free radicals, carbocations and carbanions; stability of carbocations and free radicals, electrophiles and nucleophiles.

#### Electronic displacement in a covalent bond

- Inductive effect, electromeric effect, resonance and hyperconjugation.

**Common types of organic reactions-** Substitution, addition, elimination and rearrangement.

#### UNIT 21: HYDROCARBONS

Classification, isomerism, IUPAC nomenclature, general methods of preparation, properties and reactions.

**Alkanes** - Conformations: Sawhorse and Newman projections (of ethane); Mechanism of halogenation of alkanes.

**Alkenes** - Geometrical isomerism; Mechanism of electrophilic addition: addition of hydrogen, halogens, water, hydrogen halides (Markownikoff's and peroxide effect); Ozonolysis and polymerization.

**Alkynes** - Acidic character; Addition of hydrogen, halogens, water and hydrogen halides; Polymerization.

**Aromatic hydrocarbons** - Nomenclature, benzene - structure and aromaticity; Mechanism of electrophilic substitution: halogenation, nitration, Friedel - Craft's alkylation and acylation, directive influence of functional group in mono-substituted benzene.

#### UNIT 22: ORGANIC COMPOUNDS CONTAINING HALOGENS

General methods of preparation, properties and reactions; Nature of C-X bond; Mechanisms of substitution reactions.

Uses; Environmental effects of chloroform, iodoform freons and DDT.

#### UNIT 23: ORGANIC COMPOUNDS CONTAINING OXYGEN

General methods of preparation, properties, reactions and uses.

#### ALCOHOLS, PHENOLS AND ETHERS

**Alcohols:** Identification of primary, secondary and tertiary alcohols; mechanism of dehydration.

**Phenols:** Acidic nature, electrophilic substitution reactions: halogenation, nitration and sulphonation, Reimer - Tiemann reaction.

**Ethers:** Structure.

**Aldehyde and Ketones:** Nature of carbonyl group; Nucleophilic addition to  $>C=O$  group, relative reactivities of aldehydes and ketones; Important reactions such as - Nucleophilic addition reactions (addition of HCN,  $NH_3$  and its derivatives), Grignard reagent; oxidation; reduction (Wolff Kishner and Clemmensen); acidity of  $\alpha$ -hydrogen, aldol condensation, Cannizzaro reaction, Haloform reaction;

Chemical tests to distinguish between aldehydes and Ketones.

### CARBOXYLIC ACIDS

Acidic strength and factors affecting it.

### UNIT 24: ORGANIC COMPOUNDS CONTAINING NITROGEN

General methods of preparation, properties, reactions and uses.

**Amines:** Nomenclature, classification, structure, basic character and identification of primary, secondary and tertiary amines and their basic character.

**Diazonium Salts:** Importance in synthetic organic chemistry.

### UNIT 25: POLYMERS

General introduction and classification of polymers, general methods of polymerization-addition and condensation, copolymerization;

Natural and synthetic rubber and vulcanization; some important polymers with emphasis on their monomers and uses - polythene, nylon, polyester and bakelite.

### UNIT 26: BIOMOLECULES

General introduction and importance of biomolecules.

**CARBOHYDRATES** - Classification: aldoses and ketoses; monosaccharides (glucose and fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose and maltose).

**PROTEINS** - Elementary Idea of  $\alpha$ -amino acids, peptide bond, polypeptides; Proteins: primary, secondary, tertiary and quaternary structure (qualitative idea only), denaturation of proteins, enzymes.

**VITAMINS** - Classification and functions.

**NUCLEIC ACIDS** - Chemical constitution of DNA and RNA.

Biological functions of nucleic acids.

### UNIT 27: CHEMISTRY IN EVERYDAY LIFE

**Chemicals in medicines** - Analgesics, tranquilizers, antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamins - their meaning and common examples.

**Chemicals in food** - Preservatives, artificial sweetening agents - common examples.

**Cleansing agents** - Soaps and detergents, cleansing action.

### UNIT 28: PRINCIPLES RELATED TO PRACTICAL CHEMISTRY

● Detection of extra elements (N,S, halogens) in organic compounds; Detection of the following

functional groups: hydroxyl (alcoholic and phenolic), carbonyl (aldehyde and ketone), carboxyl and amino groups in organic compounds.

● Chemistry involved in the preparation of the following:

Inorganic compounds: Mohr's salt, potash alum.

Organic compounds: Acetanilide, p-nitroacetanilide, aniline yellow, iodoform.

● Chemistry involved in the titrimetric exercises - Acids bases and the use of indicators, oxalic-acid vs  $\text{KMnO}_4$ , Mohr's salt vs  $\text{KMnO}_4$ .

● Chemical principles involved in the qualitative salt analysis:

Cations -  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{NH}_4^+$ .

Anions-  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ . (Insoluble salts excluded).

● Chemical principles involved in the following experiments:

1. Enthalpy of solution of  $\text{CuSO}_4$
2. Enthalpy of neutralization of strong acid and strong base.
3. Preparation of lyophilic and lyophobic sols.
4. Kinetic study of reaction of iodide ion with hydrogen peroxide at room temperature.

### SYLLABUS FOR APTITUDE TEST B.ARCH/B.PLANNING

Part - I Awareness of persons, places, Buildings, Materials.) Objects, Texture related to Architecture and build-environment. Visualising three dimensional objects from two dimensional drawings. Visualising different sides of three dimensional objects. Analytical Reasoning Mental Ability (Visual, Numerical and Verbal).

Part - II Three dimensional - perception: Understanding and appreciation of scale and proportion of objects, building forms and elements, colour texture, harmony and contrast. Design and drawing of geometrical or abstract shapes and patterns in pencil. Transformation of forms both 2 D and 3 D union, subtraction, rotation, development of surfaces and volumes, Generation of Plan, elevations and 3 D views of objects. Creating two dimensional and three dimensional compositions using given shapes and forms.

Sketching of scenes and activities from memory of urbanscape (public space, market, festivals, street scenes, monuments, recreational spaces etc.), landscape (river fronts, jungles, gardens, trees, plants etc.) and rural life.

Note: Candidates are advised to bring pencils, own geometry box set, erasers and colour pencils and crayons for the Aptitude Test.

# **BIOLOGY**

## **CONTENTS OF CLASS XI SYLLABUS**

### **UNIT I: Diversity in Living World**

What is living? ; Biodiversity; Need for classification; Three domains of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy – Museums, Zoos, Herbaria, Botanical gardens.

Five kingdom classification; salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids.

Salient features and classification of plants into major groups-Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (three to five salient and distinguishing features and at least two examples of each category); Angiosperms- classification up to class, characteristic features and examples).

Salient features and classification of animals-nonchordate up to phyla level and chordate up to classes level (three to five salient features and at least two examples).

### **UNIT II: Structural Organisation in Animals and Plants**

Morphology and modifications; Tissues; Anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence- cymose and racemose, flower, fruit and seed (To be dealt along with the relevant practical of the Practical Syllabus).

Animal tissues; Morphology, anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of an insect (cockroach). (Brief account only)

### **UNIT III: Cell Structure and Function**

Cell theory and cell as the basic unit of life; Structure of prokaryotic and eukaryotic cell; Plant cell and animal cell; Cell envelope, cell membrane, cell wall; Cell organelles-structure and function; Endomembrane system-endoplasmic reticulum, Golgi bodies, lysosomes, vacuoles; mitochondria, ribosomes, plastids, micro bodies; Cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); Nucleus-nuclear membrane, chromatin, nucleolus.

Chemical constituents of living cells: Biomolecules-structure and function of proteins, carbohydrates, lipids, nucleic acids; Enzymes-types, properties, enzyme action.

B Cell division: Cell cycle, mitosis, meiosis and their significance.

## **UNIT IV: Plant Physiology**

Transport in plants: Movement of water, gases and nutrients; Cell to cell transport-Diffusion, facilitated diffusion, active transport; Plant – water relations – Imbibition, water potential, osmosis, plasmolysis; Long distance transport of water – Absorption, apoplast, symplast, transpiration pull, root pressure and guttation; Transpiration-Opening and closing of stomata; Uptake and translocation of mineral nutrients-Transport of food, phloem transport, Mass flow hypothesis; Diffusion of gases (brief mention).

Mineral nutrition: Essential minerals, macro and micronutrients and their role; Deficiency symptoms; Mineral toxicity; Elementary idea of Hydroponics as a method to study mineral nutrition; Nitrogen metabolism-Nitrogen cycle, biological nitrogen fixation.

Photosynthesis: Photosynthesis as a means of Autotrophic nutrition; Site of photosynthesis take place; pigments involved in Photosynthesis (Elementary idea); Photochemical and biosynthetic phases of photosynthesis; Cyclic and noncyclic and photophosphorylation; Chemiosmotic hypothesis; Photorespiration C<sub>3</sub> and C<sub>4</sub> pathways; Factors affecting photosynthesis.

Respiration: Exchange gases; Cellular respiration-glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); Energy relations-Number of ATP molecules generated; Amphibolic pathways; Respiratory quotient.

Plant growth and development: Seed germination; Phases of Plant growth and plant growth rate; Conditions of growth; Differentiation, dedifferentiation and redifferentiation; Sequence of developmental process in a plant cell; Growth regulators-auxin, gibberellin, cytokinin, ethylene, ABA; Seed dormancy; Vernalisation;

## **UNIT V: Human Physiology**

Digestion and absorption; Alimentary canal and digestive glands; Role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; Caloric value of proteins, carbohydrates and fats; Egestion; Nutritional and digestive disorders – PEM, indigestion, constipation, vomiting, jaundice, diarrhea.

Breathing and Respiration: Respiratory organs in animals (recall only); Respiratory system in humans; Mechanism of breathing and its regulation in humans-Exchange of gases, transport of gases and regulation of respiration Respiratory volumes; Disorders related to respiration- Asthma, Emphysema, Occupational respiratory disorders.

Body fluids and circulation: Composition of blood, blood groups, coagulation of blood; Composition of lymph and its function; Human circulatory system-Structure of human heart and blood vessels; Cardiac cycle, cardiac output, ECG, Double circulation; Regulation of cardiac activity; Disorders of circulatory system-Hypertension, Coronary artery disease, Angina pectoris, Heart failure.

Excretory products and their elimination: Modes of excretion- Ammonotelism, ureotelism, uricotelism; Human excretory system-structure and function; Urine formation, Osmoregulation; Regulation of kidney function-Renin-angiotensin, Atrial Natriuretic Factor, ADH and Diabetes insipidus; Role of other organs in excretion; Disorders; Uraemia, Renal failure, Renal calculi, Nephritis; Dialysis and artificial kidney.

Locomotion and Movement: Types of movement- ciliary, flagellar, muscular; Skeletal muscle- contractile proteins and muscle contraction; Skeletal system and its functions (To be dealt with the relevant practical of Practical syllabus); Joints; Disorders of muscular and skeletal system- Myasthenia gravis, Tetany, Muscular dystrophy, Arthritis, Osteoporosis, Gout.

Neural control and coordination: Neuron and nerves; Nervous system in humans- central nervous system, peripheral nervous system and visceral nervous system; Generation and conduction of nerve impulse; Reflex action; Sense organs; Elementary structure and function of eye and ear.

Chemical coordination and regulation: Endocrine glands and hormones; Human endocrine system-Hypothalamus, Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Gonads; Mechanism of hormone action (Elementary Idea); Role of hormones as messengers and regulators, Hypo- and hyperactivity and related disorders (Common disorders e.g. Dwarfism, Acromegaly, Cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease).

*(Imp: Diseases and disorders mentioned above to be dealt in brief.)*

## **CONTENTS OF CLASS XII SYLLABUS**

### **UNIT I: Reproduction**

Reproduction in organisms: Reproduction, a characteristic feature of all organisms for continuation of species; Modes of reproduction – Asexual and sexual; Asexual reproduction; Modes-Binary fission, sporulation, budding, gemmule, fragmentation; vegetative propagation in plants.

Sexual reproduction in flowering plants: Flower structure; Development of male and female gametophytes; Pollination-types, agencies and examples; Outbreeding devices; Pollen-Pistil interaction; Double fertilization; Post fertilization events-Development of endosperm and embryo, Development of seed and formation of fruit; Special modes-apomixis, parthenocarpy, polyembryony; Significance of seed and fruit formation.

Human Reproduction: Male and female reproductive systems; Microscopic anatomy of testis and ovary; Gametogenesis-spermatogenesis & oogenesis; Menstrual cycle; Fertilisation, embryo development upto blastocyst formation, implantation; Pregnancy and placenta formation (Elementary idea); Parturition (Elementary idea); Lactation (Elementary idea).

Reproductive health: Need for reproductive health and prevention of sexually transmitted diseases (STD); Birth control-Need and Methods, Contraception and Medical Termination of Pregnancy (MTP); Amniocentesis; Infertility and assisted reproductive technologies – IVF, ZIFT, GIFT (Elementary idea for general awareness).

## **UNIT II: Genetics and Evolution**

Heredity and variation: Mendelian Inheritance; Deviations from Mendelism-Incomplete dominance, Co-dominance, Multiple alleles and Inheritance of blood groups, Pleiotropy; Elementary idea of polygenic inheritance; Chromosome theory of inheritance; Chromosomes and genes; Sex determination-In humans, birds, honey bee; Linkage and crossing over; Sex linked inheritance-Haemophilia, Colour blindness; Mendelian disorders in humans-Thalassemia; Chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Molecular basis of Inheritance: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; Transcription, genetic code, translation; Gene expression and regulation-Lac Operon; Genome and human genome project; DNA finger printing.

Evolution: Origin of life; Biological evolution and evidences for biological evolution from Paleontology, comparative anatomy, embryology and molecular evidence); Darwin's contribution, Modern Synthetic theory of Evolution; Mechanism of evolution-Variation (Mutation and Recombination) and Natural Selection with examples, types of natural selection; Gene flow and genetic drift; Hardy-Weinberg's principle; Adaptive Radiation; Human evolution.

## **UNIT III: Biology and Human Welfare**

Health and Disease; Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis. Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology-vaccines; Cancer, HIV and AIDS; Adolescence, drug and alcohol abuse.

Improvement in food production; Plant breeding, tissue culture, single cell protein, Biofortification; Apiculture and Animal husbandry.

Microbes in human welfare: In household food processing, industrial production, sewage treatment, energy generation and as biocontrol agents and biofertilizers.

## **UNIT IV: Biotechnology and Its Applications**

Principles and process of Biotechnology: Genetic engineering (Recombinant DNA technology).

Application of Biotechnology in health and agriculture: Human insulin and vaccine production, gene therapy; Genetically modified organisms-Bt crops; Transgenic Animals; Biosafety issues- Biopiracy and patents.

## **UNIT V: Ecology and environment**

Organisms and environment: Habitat and niche; Population and ecological adaptations; Population interactions-mutualism, competition, predation, parasitism; Population attributes-growth, birth rate and death rate, age distribution.

Ecosystem: Patterns, components; productivity and decomposition; Energy flow; Pyramids of number, biomass, energy; Nutrient cycling (carbon and phosphorous); Ecological succession; Ecological Services-Carbon fixation, pollination, oxygen release.

Biodiversity and its conservation: Concept of Biodiversity; Patterns of Biodiversity; Importance of Biodiversity; Loss of Biodiversity; Biodiversity conservation; Hotspots, endangered organisms, extinction, Red Data Book, biosphere reserves, National parks and sanctuaries.

Environmental issues: Air pollution and its control; Water pollution and its control; Agrochemicals and their effects; Solid waste management; Radioactive waste management; Greenhouse effect and global warming; Ozone depletion; Deforestation; Any three case studies as success stories addressing environmental issues.



## Syllabus for BBA

### Section A:

#### Quantitative Aptitude & Numerical Ability

- Number Series
- Number System
- Simplification
- Average
- Percentage
- Profit and Loss
- Ratio and proportion
- Mixture or Allegations
- Time and Work
- Time, Space and Distance
- Simple Interest and Compound Interest
- Plane Geometry
- Clocks and Calendars
- Permutation, Combination and Probability
- Data Interpretation
- Data Sufficiency

### Section B:

#### Logical Ability & Reasoning

- Alphabet Test
- Word Formation
- Coding-Decoding
- Analogy Test
- Classification
- Series
- Seating Arrangement
- Number, ranking and Time Sequence Test
- Direction Sense Test
- Blood Relations
- Mathematical Operations
- Analytical Reasoning
- Logical Order of Words
- Input-Output
- Data Sufficiency

### Section C:

#### English Language

- Rearrangement
- Sentence Completion
- Sentence Improvement
- Synonyms and Antonyms
- Spelling Test
- One Word Substitution

### Section D:

#### General Knowledge and Corporate awareness

##### General Knowledge:

- History
- Geography
- Indian Polity
- Indian Economy

##### Corporate awareness

- Public Sector Undertakings
- Profile of Important Industries in India
- Corporate Profiles of Top Global Companies

# Syllabus for BCA

## Section-A

### English Language & Comprehension

- Spotting Errors
- Rearrangement
- Sentence Completion
- Sentence Completion
- Sentence Improvement
- Synonyms and Antonyms
- Spelling Test
- One Word Substitution
- Idioms and Phrases
- Cloze Test
- Reading Comprehension

## Section-C

### Mathematics

- Sets, Relations and Functions
- Complex Number and Quadratic Equations
- Sequence and Series
- Matrices and Determinants
- Permutations and Combinations
- Binomial Theorem
- Probability
- Trigonometric Ratios and Equations
- Properties of Triangles and Inverse Trigonometric

### Functions

- Cartesian System and Lines
- Circle
- Conic Section
- Limits, Continuity and Differentiability
- Differential Coefficient and Its Application
- Indefinite Integration
- Definite Integration and Its Applications
- Different Equations
- Vector Algebra and Three Dimensional 5 Pace
- Statistics

## Section-B

### Logical Ability & Reasoning

- Alphabet Test
- Word Formation
- Coding – Decoding
- Analogy Test
- Classification
- Series Test
- Sitting Arrangement
- Number, Ranking and Time Sequence Test
- Direction Sense Test
- Blood Relations
- Mathematical Operations
- Analytical Reasoning
- Logical order of words
- Input-Output
- Data Sufficiency
- Eligibility Test
- Statement and it's Products
- Assertion and Reason
- Cause and Reason
- Syllogism
- Venn-Diagram
- Cube and Dice
- Figure Analogy
- Image Test
- Counting of Figures Completion of Figures
- Paper Folding and Paper Cutting
- Embedded Figures
- Formation of Figures
- Grouping of Identical Figures

## Section-D (Subjective Knowledge)

### Computer Awareness:

- Computer Fundamentals and PC Applications
- Operating Systems
- Computer hardware parts and controls
- Basic computer terminology
- Basic internet knowledge and protocols
- Database Management System, Number System
- Operating System,
- History of Computer, Network basics (LAN & WAN)
- Computer abbreviation,
- Security Tools, Virus, Hacking
- Software names and usages (Microsoft Office) And Computer Shortcuts.

## Syllabus for BHMCT/ B.Sc. (HM& CT)

### Section A: General English

Comprehension of passage, Verbal Reasoning, Syllogisms, Antonyms, Fill in the Blanks, Jumbled paragraphs with 4 or 5 sentences, Sentence Correction, Sentence completion, Sentence Correction, odd man out, idioms, one-word substitution, Different usage of same word etc.

### Section B: General Knowledge

Current National and International Affairs, Business, Punch line of companies, Top officials of big companies, Major corporate events, Trade and Commerce, Famous award and prizes Science, Scientific Inventions, Social Science, Geography, International organizations History, Social issues, Culture, Entertainment, Politics etc. Sports, Finance, Automobiles, Travel and Tourism

### Section C: Reasoning

Critical reasoning, Visual reasoning, Assumption – Premise – Conclusion, Assertion and reasons, Statements and assumptions, identifying valid inferences, identifying Strong arguments and Weak arguments, Statements and Conclusions, Cause and Effect, Identifying Probably true, Probably false, definitely true, definitely false kind of statement, Linear arrangements, Matrix arrangements.

Puzzles, Syllogisms, Functions, Family tree – identifying relationship among group of people, Symbol Based problems, Coding and decoding, Sequencing, identifying next number in series, etc.

### Section D:

**Data Interpretation:** There will be questions of data interpretation which will be mostly based of various graphs.

**Graphs :**Column graphs, Bar Graphs, Line charts, Pie Chart, Graphs representing Area, Venn diagram etc.

## Syllabus for M.Tech

### SECTION- A (Common to all branches)

#### General Aptitude

- (a) Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.
- (b) Numerical Ability: Numerical computation, numerical estimation, numerical reasoning and data interpretation.

### SECTION- B Branch wise Syllabus for M.Tech. Civil Engineering (CE)

#### (a) *Engineering Mathematics*

Linear Algebra: Matrix algebra, Systems of linear equations, Eigen values and eigenvectors.

Calculus: Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

Differential equations: First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

Complex variables: Analytic functions, Cauchy's integral theorem, Taylor and Laurent series. Probability and Statistics: Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

Numerical Methods: Numerical solutions of linear and non-linear algebraic equations  
Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

**(b) Structural Engineering**

**Mechanics:** Bending moment and shear force in statically determinate beams. Simple stress and strain relationship: Stress and strain in two dimensions, principal stresses, stress transformation, Mohr's circle. Simple bending theory, flexural and shear stresses, unsymmetrical bending, shear centre. Thin walled pressure vessels, uniform torsion, buckling of column, combined and direct bending stresses.

**Structural Analysis:** Analysis of statically determinate trusses, arches, beams, cables and frames, displacements in statically determinate structures and analysis of statically indeterminate structures by force/ energy methods, analysis by displacement methods (slope deflection and moment distribution methods), influence lines for determinate and indeterminate structures. Basic concepts of matrix methods of structural analysis.

**Concrete Structures:** Concrete Technology- properties of concrete, basics of mix design. Concrete design-basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of prestressed concrete, analysis of beam sections at transfer and service loads.

**Steel Structures:** Analysis and design of tension and compression members, beams and beam- columns, column bases. Connections- simple and eccentric, beam-column connections, plate girders and trusses. Plastic analysis of beams and frames.

**(c) Geotechnical Engineering**

**Soil Mechanics:** Origin of soils, soil classification, three-phase system, fundamental definitions, relationship and interrelationships, permeability & seepage, effective stress principle, consolidation, compaction, shear strength.

**Foundation Engineering:** Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, plate load test. Earth pressure theories, effect of water table, layered soils. Stability of slopes-infinite slopes, finite slopes. Foundation types-foundation design requirements. Shallow foundations-bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sands & clays. Deep foundations-pile types, dynamic & static formulae, load capacity of piles in sands & clays, negative skin friction

**(d) Water Resources Engineering**

**Fluid Mechanics and Hydraulics:** Properties of fluids, principle of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, critical flow and gradually varied flow in

channels, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling. Kinematics of flow, velocity triangles and specific speed of pumps and turbines.

**Hydrology:** Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

**Irrigation:** Duty, delta, estimation of evapo-transpiration. Crop water requirements. Design of: lined and unlined canals, waterways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage, sodic soils.

**(e) *Environmental Engineering***

**Water requirements:** Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, sludge disposal, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment Unit operations and unit processes of domestic wastewater, sludge disposal.

**Air Pollution:** Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

**Municipal Solid Wastes:** Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

**Noise Pollution:** Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

**(f) *Transportation Engineering***

**Highway Planning:** Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements.

**Traffic Engineering:** Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

**(g) *Surveying***

Importance of surveying, principles and classifications, mapping concepts, coordinate

system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying, errors and adjustments, curves.

## **Computer Science and Information Technology (CS)**

### **(a) *Engineering Mathematics***

**Mathematical Logic:** Propositional Logic; First Order Logic.

**Probability:** Conditional Probability; Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; uniform, normal, exponential, Poisson, Binomial.

**Set Theory & Algebra:** Sets; Relations; Functions; Groups; Partial Orders; Lattice; Boolean Algebra.

**Combinatorics:** Permutations; Combinations; Counting; Summation; generating functions; recurrence relations; asymptotics.

**Graph Theory:** Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

**Linear Algebra:** Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.

**Numerical Methods:** LU decomposition for systems of linear equations; numerical solutions of nonlinear algebraic equations by Secant, Bisection and Newton-Raphson Methods; Numerical integration by trapezoidal and Simpson's rules.

**Calculus:** Limit, Continuity & differentiability, Mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, Partial derivatives, Total derivatives, maxima & minima.

### **(b) *Computer Science and Information Technology***

**Digital Logic:** Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point).

**Computer Organization and Architecture:** Machine instructions and addressing modes, ALU and datapath, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

**Programming and Data Structures:** Programming in C; Functions, Recursion, Parameter

passing, Scope, Binding; Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

**Algorithms:** Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes – P, NP, NP-hard, NP-complete.

**Theory of Computation:** Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Undecidability.

**Compiler Design:** Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target code generation, Basics of code optimization.

**Operating System:** Processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

**Databases:** ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+trees), Transactions and concurrency control.

**Information Systems and Software Engineering:** information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding, testing, implementation, maintenance.

**Computer Networks:** ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security – basic concepts of public key and private key cryptography, digital signature, firewalls.

**Web technologies:** HTML, XML, basic concepts of client-server computing.

## Electronics and Communication Engineering (ECE)

### (a) *Engineering Mathematics*

Linear Algebra: Matrix Algebra, Systems of linear equations, Eigen values and eigen vectors.

**Calculus:** Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, Multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method.

**Complex variables:** Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, Residue theorem, solution integrals.

**Probability and Statistics:** Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

**Numerical Methods:** Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

**Transform Theory:** Fourier transform, Laplace transform, Z-transform.

### (b) *Electronics and Communication Engineering*

**Networks:** Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks.

**Electronic Devices:** Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASERS. Device

technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process.

**Analog Circuits:** Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single- and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies.

**Digital circuits:** Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shift registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. Microprocessor (8085): architecture, programming, memory and I/O interfacing.

**Signals and Systems:** Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform.

Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems.

**Control Systems:** Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

**Communications:** Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers,

bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM.

**Electromagnetics:** Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain.

## **Mechanical Engineering (ME)**

### **(a) *Engineering Mathematics***

**Linear Algebra:** Matrix algebra, Systems of linear equations, Eigen values and eigen vectors.

**Calculus:** Functions of single variable, Limit, continuity and differentiability, Mean value theorems, Evaluation of definite and improper integrals, Partial derivatives, Total derivative, Maxima and minima, Gradient, Divergence and Curl, Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equations (linear and nonlinear), Higher order linear differential equations with constant coefficients, Cauchy's and Euler's equations, Initial and boundary value problems, Laplace transforms, Solutions of one dimensional heat and wave equations and Laplace equation.

**Complex variables:** Analytic functions, Cauchy's integral theorem, Taylor and Laurent series.

**Probability and Statistics:** Definitions of probability and sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Poisson, Normal and Binomial distributions.

**Numerical Methods:** Numerical solutions of linear and non-linear algebraic equations Integration by trapezoidal and Simpson's rule, single and multi-step methods for differential equations.

### **(b) *Applied Mechanics And Design***

**Engineering Mechanics:** Free body diagrams and equilibrium; trusses and frames; virtual

work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

**Strength of Materials:** Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; strain energy methods; thermal stresses.

**Theory of Machines:** Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains; flywheels.

**Vibrations:** Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

**Design:** Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; *principles* of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

(c) ***Fluid Mechanics And Thermal Sciences***

**Fluid Mechanics:** Fluid properties; fluid statics, manometry, buoyancy; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends etc.

**Heat-Transfer:** Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

**Thermodynamics:** Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle. irreversibility and availability; behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

**Applications:** *Power Engineering:* Steam Tables, Rankine, Brayton cycles with regeneration and reheat. *I.C. Engines:* air-standard Otto, Diesel cycles. *Refrigeration and air-conditioning:* Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychrometric chart, basic psychrometric processes. *Turbomachinery:* Pelton-wheel, Francis and Kaplan turbines — impulse and reaction principles, velocity diagrams.

(d) ***Manufacturing And Industrial Engineering***

**Engineering Materials:** Structure and properties of engineering materials, heat treatment, stress-strain diagrams for engineering materials.

**Metal Casting:** Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations.

**Forming:** Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy.

**Joining:** Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

**Machining and Machine Tool Operations:** Mechanics of machining, single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of nontraditional machining processes; principles of work holding, principles of design of jigs and fixtures.

**Metrology and Inspection:** Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

**Computer Integrated Manufacturing:** Basic concepts of CAD/CAM and their integration tools.

**Production Planning and Control:** Forecasting models, aggregate production planning, scheduling, materials requirement planning.

**Inventory Control:** Deterministic and probabilistic models; safety stock inventory control systems.

**Operations Research:** Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM

## SECTION- C (Common to all branches)*Engineering Mathematics*

**Linear Algebra:** Algebra of matrices, inverse, rank, system of linear equations, symmetric, skewsymmetric and orthogonal matrices. Hermitian, skew-Hermitian and unitary matrices. eigenvalues and eigenvectors, diagonalisation of matrices, Cayley-Hamilton Theorem.

**Calculus:** Functions of single variable, limit, continuity and differentiability, Mean value theorems, Indeterminate forms and L'Hospital rule, Maxima and minima, Taylor's series, Fundamental and mean value-theorems of integral calculus. Evaluation of definite and improper integrals, Beta and Gamma functions, Functions of two variables, limit, continuity, partial derivatives, Euler's theorem for homogeneous functions, total derivatives, maxima and minima, Lagrange method of multipliers, double and triple integrals and their applications, sequence and series, tests for convergence, power series, Fourier Series, Half range sine and cosine series.

**Complex variable:** Analytic functions, Cauchy-Riemann equations, Application in solving potential problems, Line integral, Cauchy's integral theorem and integral formula (without proof), Taylor's and Laurent's series, Residue theorem (without proof) and its applications.

**Vector Calculus:** Gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, Stokes, Gauss and Green's theorems (without proofs) applications.

**Ordinary Differential Equations:** First order equation (linear and nonlinear), Second order linear differential equations with variable coefficients, Variation of parameters method, higher order linear differential equations with constant coefficients, Cauchy- Euler's equations, power series solutions, Legendre polynomials and Bessel's functions of the first kind and their properties.

**Partial Differential Equations:** Separation of variables method, Laplace equation, solutions of one dimensional heat and wave equations.

**Probability and Statistics:** Definitions of probability and simple theorems, conditional probability, Bayes Theorem, random variables, discrete and continuous distributions, Binomial, Poisson, and normal distributions, correlation and linear regression.

**Numerical Methods:** Solution of a system of linear equations by L-U decomposition, Gauss-Jordan and Gauss-Seidel Methods, Newton's interpolation formulae, Solution of a polynomial and a transcendental equation by Newton-Raphson method, numerical integration by trapezoidal rule, Simpson's rule and Gaussian quadrature, numerical solutions of first order differential equation by Euler's method and 4<sup>th</sup> order Runge-Kutta method.

## SYLLABUS FOR M. PHARMACY

### SECTION-A

#### **General Aptitude (GA):**

(c) Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

(d) Numerical Ability: Numerical computation, numerical estimation, numerical reasoning and data interpretation.

### SECTION-B PHARMACEUTICS

**Micromeritics and Powder Rheology:** Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, methods of determining particle size- optical microscopy, sieving, sedimentation; measurements of particle shape, specific surface area; methods for determining surface area; permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

**Viscosity and Rheology:** Newtonian systems, Law of flow, kinematic viscosity, effect of temperature; non-Newtonian systems: pseudoplastic, dilatant, plastic; thixotropy, thixotropy in formulation, negative thixotropy, determination of viscosity, capillary, falling ball, rotational viscometers.

**Dispersion Systems:** Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian motion, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations; Emulsions-types, theories, physical stability. .

**Liquid Dosages Forms:** Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors and others, manufacturing packaging, labeling, evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia

**Semisolid Dosage Forms:** Definitions, types, mechanisms of drug penetration, factor influencing penetration, semisolid bases and their selection. General formulation of semisolids, clear gels manufacturing procedure, evaluation and packaging;

**Suppositories:** Ideal requirements, bases, displacement value, manufacturing procedure, packaging and evaluation;

**Pharmaceutical Aerosols:** Definition, propellants, general formulation, manufacturing' and packaging methods, pharmaceutical applications;

**Ophthalmic Preparations:** Requirements, formulation, methods of preparation, labeling, containers, evaluation;

**Capsules:** Advantages and disadvantages of capsule dosage form, material for production of hard gelatin capsules, size of capsules, formulation, method of capsule filling, soft gelatin, capsule shell and capsule content, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

**Micro-encapsulation:** Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, coacervation, multi-orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

**Tablets:** Advantages and disadvantages of tablets, Application of different types of tablets, Formulation of different types of tablets, granulation, technology on large-scale by various techniques, different types of tablet compression machinery and the equipments employed, evaluation of tablets. Coating of Tablets: Types of coating, film forming materials, formulation of coating solution, equipments for coating, coating process, evaluation of coated tablets. Stability kinetics and quality assurance.

**Parenteral Products:** Pre-formulation factors, routes of administration, water for injection, and sterile water for injection, pyrogenicity, non aqueous vehicles, isotonicity and methods of its adjustment, Formulation details, Containers and closures and selection, labeling; Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization& preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products; Aseptic Techniques-source of contamination and methods of prevention, Design of aseptic area, Laminar flow bench services and maintenance. Sterility testing of pharmaceuticals.

**Packaging of Pharmaceutical Products:** Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influence choice of containers, legal and official requirements for containers, package testing.

**Designing of dosage forms:** Pre-formulation studies, Study of physical properties of drug like physical form, particle size, shape, density, wetting, dielectric constant. Solubility, dissolution and organoleptic properties and their effect on formulation, stability and bioavailability. Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc., and their influence on formulation and stability of products. Study of pro-drugs in solving problems related to stability, bioavailability and elegance of formulations. Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions. Stabilization and stability testing protocol for various pharmaceutical products. ICH guidelines for stability testing of formulations.

**Performance evaluation methods:** In-vitro dissolution studies for solid dosage forms methods, interpretation of dissolution data. Bioavailability studies and bioavailability testing protocol and procedures. In vivo methods of evaluation and statistical treatment. GMP and quality assurance, Quality audit. Design, development, production and evaluation of controlled/sustained/extended release formulations.

**Biopharmaceutic:** Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion, ion-pair formation and pinocytosis); Factors influencing absorption- biological, physico-chemical, physiological and pharmaceutical; Drug distribution in the body, plasma protein binding.

**Pharmacokinetics:** Significance of plasma drug concentration measurement. Compartment model- Definition and Scope. Pharmacokinetics of drug absorption - Zero order and first order absorption rate constant using Wagner-Nelson and residual methods. Volume of distribution and distribution coefficient. Compartment kinetics- One compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route. Clearance concept, mechanism of renal clearance, clearance ratio, determination of renal clearance. Extraction ratio, hepatic clearance, biliary excretion, extra-hepatic circulation. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration.

**Clinical Pharmacokinetics:** Definition and scope: Dosage adjustment in patients with and without renal and hepatic failure; Design of single dose bio-equivalence study and relevant statistics; Pharmacokinetic drug interactions and their significance in combination therapy.

**Bioavailability and bioequivalence:** Measures of bioavailability,  $C_{max}$ ,  $t_{max}$ ,  $K_{el}$  and Area Under the Curve (AUC); Design of single dose bioequivalence study and relevant statistics; Review of regulatory requirements for conducting bioequivalent studies. Biopharmaceutical Classification System (BCS) of drugs.

## PHARMACEUTICAL CHEMISTRY

**Basic Principles:** Physico-chemical and stereoisomeric (Optical, geometrical) aspects of drug molecules and biological action, Bioisosterism, Drug-receptor interactions including transduction mechanisms; Drug metabolism and Concept of Prodrugs; Principles of Drug Design (Theoretical Aspects) Traditional analog and mechanism based approaches, QSAR approaches, Applications of quantum mechanics, Computer Aided Drug Designing (CADD) and molecular modelling

**Synthetic Procedures, Mode of Action, Uses, Structure Activity Relationships including physicochemical Properties of the Following Classes of Drugs**

Drugs acting at synaptic and neuro-effector junction sites; Cholinergics, anti-cholinergics and cholinesterase inhibitor; Adrenergic drugs; Antispasmodic and anti-ulcer drugs; Local Anesthetics; Neuromuscular blocking agents; Autacoids, Steroidal Drugs; Drugs acting on the central nervous system; Diuretics; Anti-hypertensives; Anti-arrhythmic agents, anti-anginal agents, Cardiotonics; Anti-hyperlipidemic agents; Anticoagulants and Anti-platelet drugs; Thyroid and Anti thyroid drugs; Insulin and oral hypoglycemic agents; Chemotherapeutic Agents used in bacterial, fungal, viral, protozoal, parasitic and other infections, Antibiotics:  $\beta$ -Lactam, macrolides, tetracyclines, aminoglycosides, polypeptide antibiotics, fluoroquinolones; Anti-neoplastic agents; Anti-viral agents (including anti-HIV); Immunosuppressives and immunostimulants; Diagnostic agents; Pharmaceutical Aids;

**Basic Principles of pharmaceutical analysis:** Preliminaries and definitions, Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision and accuracy,

**Chromatography:** Theory of chromatography, plate theory, Factors affecting resolution, van Deemter equation, The following chromatographic techniques (including instrumentation) with relevant examples of Pharmacopoeial products: TLC, HPLC, GLC, HPTLC, Paper Chromatography and Column Chromatography;

**Theoretical Aspects, Basic Instrumentation, Elements of Interpretation of Spectra, and applications (quantitative and qualitative) of the following**

Ultraviolet and visible spectrophotometry, Fluorimetry, Infrared spectrophotometry, Nuclear Magnetic Resonance spectroscopy, Mass Spectrometry (EI & CI only), Flame Photometry, Atomic Absorption Spectroscopy, X-ray Diffraction Analysis, Radioimmunoassay.

## PHARMACOLOGY

**Basic Principles of Cell Injury and Adaptations:** Causes of Cellular injury, pathogenesis, morphology of cell injury, adaptations and cell death.

**Basic Mechanisms involved in the process of inflammation and repair:** Vascular and cellular events of acute inflammation, chemical mediators of inflammation, pathogenesis of chronic inflammation, brief outline of the process of repair.

**Immunopathophysiology:** T and B cells, MHC proteins, antigen presenting cells, immune tolerance, pathogenesis of hypersensitivity reactions, autoimmune diseases, AIDS, Amyloidosis.

**Pathophysiology of Common Diseases:** Asthma, diabetes, rheumatoid arthritis, gout, ulcerative colitis, neoplasia, psychosis, depression, mania, epilepsy, acute and chronic renal failure, hypertension, angina, congestive heart failure, atherosclerosis, myocardial infarction, congestive heart failure, peptic ulcer, anemias, hepatic disorders, tuberculosis, urinary tract infections and sexually transmitted diseases. Wherever applicable the molecular basis should be discussed.

**Fundamentals of general pharmacology:** Dosage forms and routes of administration, mechanism of action, combined effect of drugs, factors modifying drug action, tolerance and dependence; Pharmacogenetics; Principles of Basic and Clinical pharmacokinetics, absorption, Distribution, Metabolism and Excretion of drugs, Adverse Drug Reactions; Bioassay of Drugs and Biological Standardization; Discovery and development of new drugs, Bioavailability and bioequivalence studies;

**Pharmacology of Peripheral Nervous System:** Neurohumoral transmission (autonomic and somatic), Parasympathomimetics, Parasympatholytics, Sympathomimetics, Adrenergic receptor and neuron blocking agents, Ganglion stimulants and blocking agents, Neuromuscular blocking Agents, Local anesthetic Agents.

**Pharmacology of Central Nervous System:** Neurohumoral transmission in the C.N.S., General Anesthetics, Alcohols and disulfiram, Sedatives, Hypnotics, Anti-anxiety agents and Centrally acting muscle relaxants, Psychopharmacological agents (anti-psychotics), anti-manics and hallucinogens, Antidepressants, Anti-epileptics drugs, Anti-Parkinsonian drugs, Analgesics, Antipyretics, Narcotic analgesics and antagonists, C.N.S. stimulants, Drug Addiction and Drug Abuse.

**Pharmacology of Cardiovascular System:** Drugs used in the management of congestive cardiac failure, Antihypertensive drugs, Anti-anginal and Vasodilator drugs, including calcium channel blockers and beta adrenergic antagonists, Anti-arrhythmic drugs, Anti-hyperlipidemic drugs, Drugs used in the therapy of shock.

**Drugs Acting on the Hemopoietic System:** Hematinics, Anticoagulants, Vitamin K and hemostatic agents, Fibrinolytic and anti-platelet drugs, Blood and plasma volume expanders.

**Drugs acting on urinary system:** Fluid and electrolyte balance, Diuretics.

**Autacoids:** Histamine, Antihistaminic drugs, 5-HT- its agonists and antagonists, Prostaglandins, thromboxanes and leukotrienes, Angiotensin, Bradykinin and Substance P and other vasoactive peptides, non-steroidal anti-inflammatory and anti-gout agents.

**Drugs Acting on the Respiratory System:** Anti-asthmatic drugs including bronchodilators, Anti-tussives and expectorants, Respiratory stimulants.

**Drugs acting on the Gastrointestinal Tract:** Antacids, Anti-secretory and Anti-ulcer drugs, Laxatives and anti-diarrhoeal drugs, Appetite Stimulants and Suppressants, Emetics and anti-emetics, Miscellaneous: Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.

**Pharmacology of Endocrine System:** Hypothalamic and pituitary hormones, Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and Vitamin D, Insulin, glucagons, incretins, oral hypoglycemic agents and insulin analogs, ACTH and corticosteroids, Androgens and anabolic steroids, Estrogens, progesterone and oral contraceptives, Drugs acting on the uterus.

**Chemotherapy:** General Principles of Chemotherapy, Bacterial resistance; Sulfonamides and cotrimoxazole, Antibiotics- Penicillins, Cephalosporins, Aminoglycosides, Chloramphenicol, Macrolides, Tetracyclines, Quinolones, fluoroquinolones and Miscellaneous antibiotics; Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, HIV and AIDS, urinary tract infections and sexually transmitted diseases, malaria, amoebiasis and other protozoal infections and Anthelmintics. Chemotherapy of malignancy and immunosuppressive agents.

**Principles of Toxicology:** Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning, Heavy metals and heavy metal antagonists.

**Basic Concepts of Pharmacotherapy:** Clinical Pharmacokinetics and individualization of Drug therapy, Drug delivery systems and their Biopharmaceutic & Therapeutic considerations, Drugs used during infancy and in the elderly persons (Pediatrics & Geriatrics), Drugs used during pregnancy, Drug induced diseases, The basics of drug interactions, General principles of clinical toxicology, Common clinical laboratory tests and their interpretation

**Important Disorders of Organs, Systems and their Management:** Cardio-vascular disorders- Hypertension, Congestive heart failure, Angina, Acute myocardial infarction, Cardiac arrhythmias; CNS Disorders: Epilepsy, Parkinsonism, Schizophrenia; Depression Respiratory disease-Asthma; Gastrointestinal Disorders-Peptic ulcer, Ulcerative colitis, Hepatitis, Cirrhosis; Endocrine Disorders- Diabetes mellitus and Thyroid disorders; Infectious Diseases-Tuberculosis, Urinary tract infections, Enteric infections, Upper respiratory infections; Hematopoietic Disorders- Anemias; Joint and Connective tissue disorders-Rheumatic diseases, Gout and Hyperuricemia; Neoplastic Diseases- Acute Leukaemias, Hodgkin's disease. Therapeutic Drug Monitoring, Concept of Essential Drugs

and Rational Drug use.

## **PHARMACOGNOSY**

**Sources of Drugs:** Biological, marine, mineral and plant tissue cultures as sources of drugs

**Classification of Drugs:** Morphological, taxonomical, chemical and pharmacological classification of drugs

**Study of medicinally important plants** belonging to the families with special reference to: Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Graminae, Labiatae, Cruciferae, Papaveraceae;

**Quality Control of Crude Drugs:** Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods and properties.

**Introduction to Active Constituents of Drugs:** their isolation, classification and properties.

**Phytochemical Screening:** Preparation of extracts, Screening of alkaloids, saponins, cardenolides and bufadienolides, flavonoids and leucoanthocyanidins, tannins and polyphenols, anthraquinones, cynogenetic glycosides, amino acids in plant extracts;

### **Systematic pharmacognostic study of the followings:**

Carbohydrates and derived products: Agar, Guar gum, Acacia, Honey, Isabgol, Pectin, Starch, Sterculia and Tragacanth; Lipids: Bees wax, Castor oil, Cocoa butter, Codliver oil, Hydnocarpus oil, Kokum butter, Lard, Linseed oil, Rice, Bran oil, Shark liver oil and Wool fat; Resins: Study of Drugs Containing Resins and Resin Combinations like Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of Tolu, balsam of Peru, benzoin, turmeric, ginger; Tannins: Study of tannins and tannin containing drugs like Gambier, black catechu, gall and myrobalan; Volatile Oils: General methods of obtaining volatile oils from plants, Study of volatile oils of Mentha, Coriander, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Clove, Fennel, Nutmeg, Eucalyptus, Chenopodium, Cardamom, Valerian, Musk, Palmarosa, Gaultheria, Sandal wood;

Fibres: Study of fibers used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.

**Study of the biological sources, cultivation, collection, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs:**

**Glycoside Containing Drugs:** saponins : liquorice, ginseng, dioscorea, sarsaparilla, and senega; Cardioactiveglycosides: digitalis, squill, strophanthus and thevetia; Anthraquinone cathartics: aloe,

senna, rhubarb and cascara; Others:Psoralea, Ammimajus, Ammivisnaga, gentian, saffron, chirata, quassia.

**Alkaloid Containing Drugs:** Pyridine-piperidine:tobacco, areca and lobelia; Tropane: belladonna, hyoscyamus, datura, duboisia, coca and withania;Quinoline and Isoquinoline:Cinchona, ipecac, opium; Indole:ergot, rauwolfia, catharanthus, nux-vomica and physostigma;Imidazole:pilocarpus; Steroidal:veratrum and kurch; AlkaloidalAmine:ephedra and colchicum;Glycoalkaloid:solanum; Purines:coffee, tea and cola.

**Biological sources, preparation, identification tests and uses of the following enzymes:** Diastase, papain, pepsin, trypsin, pancreatin.

### **SECTION-C BIOCHEMISTRY**

**Biochemistry in pharmaceutical sciences:** The concept of free energy, Determination of change in free energy - from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance;

**Enzymes:** Nomenclature, enzyme kinetics and their mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis;

**Co-enzymes:** Vitamins as co-enzymes and their significance. Metals as cofactors and their significance; Carbohydrate Metabolism: Conversion of polysaccharides to glucose-1-phosphate, Glycolysis, fermentation and their regulation, Gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemia, Role of sugar nucleotides in biosynthesis, and Pentose phosphate pathway;

**The Citric Acid Cycle:** Significance, reactions and energetics of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle;

**Lipids Metabolism :**Oxidation of fatty acids,  $\beta$ -oxidation & energetics, biosynthesis of ketone bodies and their utilization, biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes), phospholipids, and sphingolipids, Biosynthesis of eicosanoids, cholesterol, androgens, progesterone, estrogens corticosteroids and bile acids;

**Biological Oxidation:** Redox-potential, enzymes and co-enzymes involved in oxidation reduction & its control, The respiratory chain, its role in energy capture and its control, energetics of oxidative phosphorylation. Inhibitors of respiratory chain and oxidative phosphorylation, Mechanism of oxidative phosphorylation;

**Metabolism of ammonia and nitrogen containing monomers:** Nitrogen balance, Biosynthesis of amino acids, Catabolism of amino acids, Conversion of amino acids to specialized products, Assimilation of ammonia, Urea. cycle, metabolic disorders of urea cycle, Metabolism of sulphur

containing amino acids;

**Purine biosynthesis:** Purine nucleotide inter-conversions;

**Pyrimidine biosynthesis** and formation of deoxyribonucleotides;

**Biosynthesis of Nucleic Acids:** Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and its replications;

**Mutation:** Physical & chemical mutagenesis/carcinogenesis, DNA repair mechanism. Biosynthesis of RNA;

**Genetic Code and Protein Synthesis:** Genetic code, Components of protein synthesis and Inhibition of protein synthesis.

## **MICROBIOLOGY**

**Structure and Classification of microbes and their taxonomy:** Actinomycetes, bacteria, rickettsiae, spirochetes and viruses;

**Identification of Microbes:** Stains and types of staining techniques, electron microscopy; Nutrition, cultivation, isolation of bacteria, actinomycetes, fungi, viruses, etc; Microbial genetics and variation;

**Control of microbes by physical and chemical methods:** Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation;

**Sterilization:** different methods, validation of sterilization methods & equipments; Sterility testing of all pharmaceutical products. Microbial assays of antibiotics, vitamins & amino acids.

**Immunology and Immunological Preparations:** antigens and heptans, immune system, cellular/humoral immunity, immunological tolerance, antigen-antibody reactions and their applications. Hypersensitivity, active and passive immunization. Vaccines and sera: their preparation, standardization and storage.

**Genetic Recombination:** Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope, HB etc;

**Antibiotics:** Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillins, streptomycin, tetracyclines and vitamin B12.

## **PHARMACEUTICAL JURISPRUDENCE (C)**

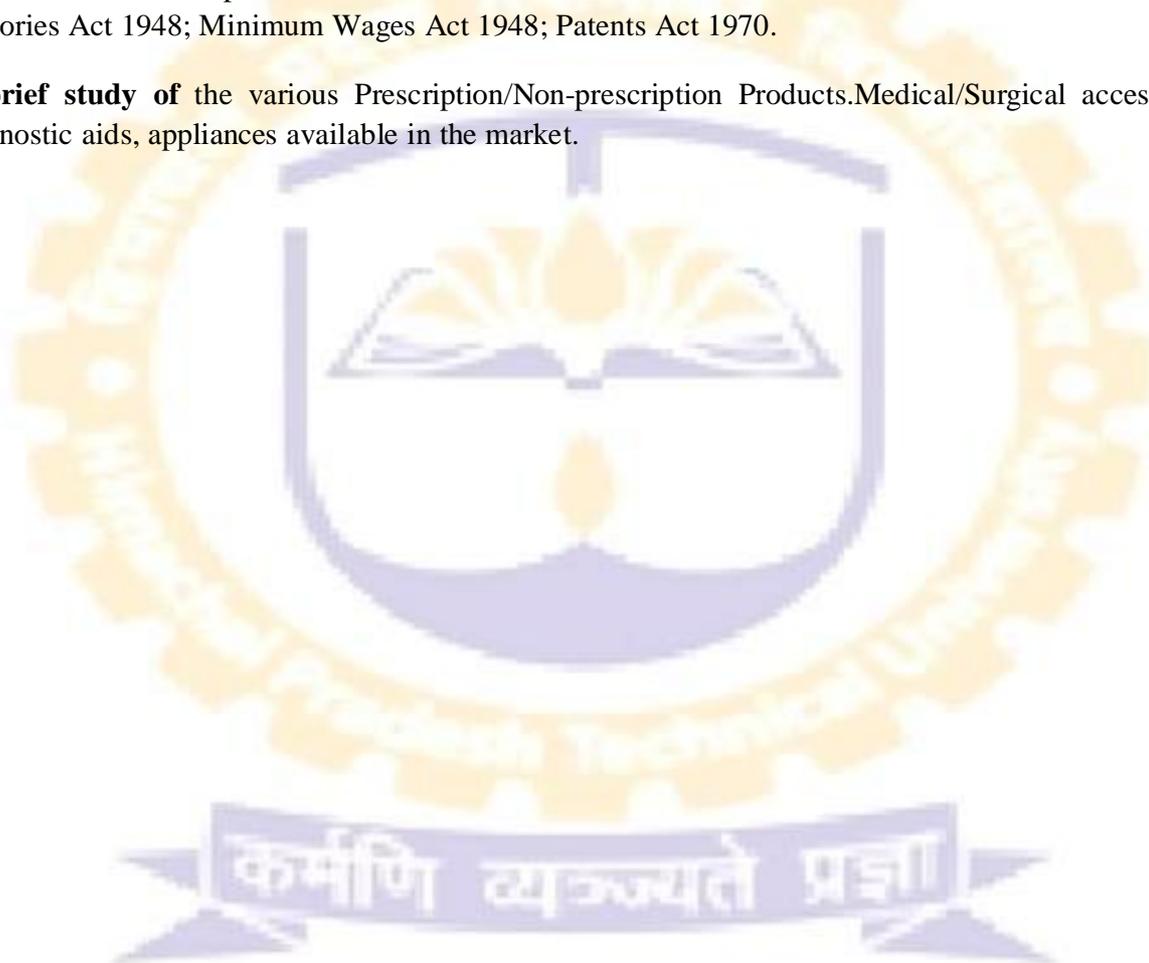
**Pharmaceutical Legislations:** A brief review of Drugs & Pharmaceutical Industry; Pharmaceutical

Education-

**An elaborate study of the followings:** Pharmaceutical Ethics; Pharmacy Act 1948; Drugs and Cosmetics Act 1940 and Rules 1945; Medicinal & Toilet Preparations (Excise Duties) Act 1955; Narcotic Drugs & Psychotropic Substances Act 1985 & Rules; Drugs Price Control Order;

**A brief study of the following Acts with special reference to the main provisions and the latest amendments:** Poisons Act 1919; Drugs and Magic Remedies (Objectionable Advertisements) Act 1954; Medical Termination of Pregnancy Act 1970 & Rules 1975; Prevention of Cruelty to Animals Act 1960; States Shops & Establishments Act & Rules; Insecticides Act 1968; AICTE Act 1987; Factories Act 1948; Minimum Wages Act 1948; Patents Act 1970.

**A brief study of** the various Prescription/Non-prescription Products. Medical/Surgical accessories, diagnostic aids, appliances available in the market.



## Syllabus for MBA/ MBA (T&HM) & MCA

### **Section-A**

#### **Verbal Ability:**

Vocabulary Based (Synonyms Antonyms), English Usage or Grammar, Sentence Correction, Fill in the blanks, Close Passage, Analogies or Reverse Analogies, Jumbled Paragraph, Meaning-Usage Match, Summary Questions, Verbal Reasoning, Facts/Inferences/Judgements, Reading Comprehension

### **Section-B**

#### **Quantitative Ability:**

Geometry (Lines, angles, Triangles, Spheres, Rectangles, Cube, Cone etc.), Ratios and Proportion, Percentages, In-equations Quadratic and linear equations, Algebra, Profit & Loss Averages, Partnership (Accounts), Time-Speed-Distance, Work and time, Number system, HCF & LCM Geometric Progression, Arithmetic progression, Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode, Number Base System, BODMAS, Menstruation, Allegation & Mixtures, Work, Pipes and Cisterns, Simple Interest & Compound Interest, Set Theory, Venn diagram, Installment Payments, Clocks, Probability, Permutations Combinations, Trigonometry, Vectors, Binomial Expansion, Co-ordinate geometry, Logarithm, Calendar, Maxima & Minima Progression, Surds & Indices, Complex numbers

### **Section-C**

#### **Data Interpretation and Reasoning:**

There will be questions of data interpretation which will be mostly based of various graphs.

#### **Graphs**

Column graphs, Bar Graphs, Line charts, Pie Chart, Graphs representing Area, Venn diagram etc.

#### **Reasoning**

Critical reasoning, Visual reasoning, Assumption-Premise-Conclusion, Assertion and reasons, Statements and assumptions, Identifying valid inferences, Identifying arguments, Statements and conclusions, Cause and Effect, Identifying probably true probably false, Definitely true definitely false kind of statement, Linear arrangements, Matrix arrangements (Puzzles, Syllogisms, Functions), Family tree - identifying relationship among group of people, Symbol Based problems, Coding and decoding, Sequencing etc.

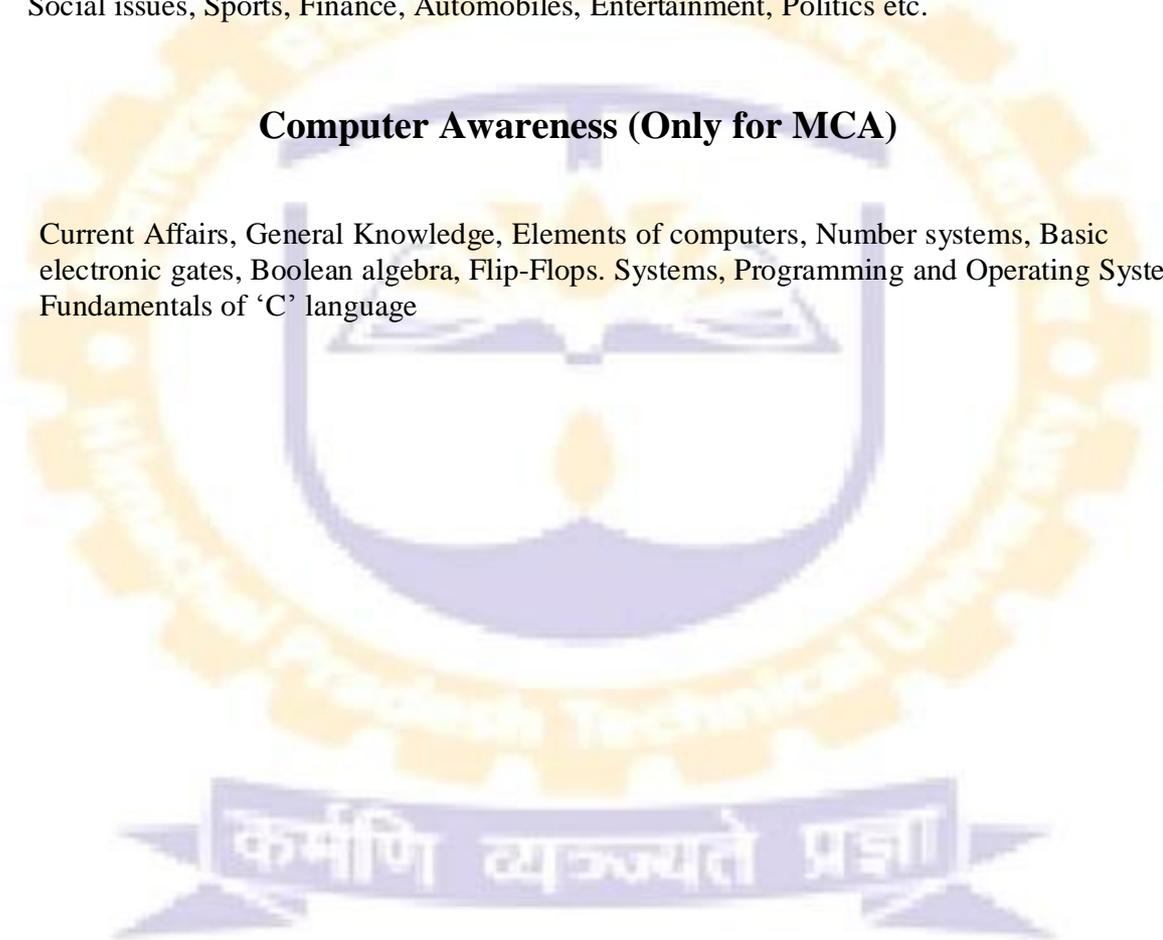
## **Section-D**

### **Business Awareness (for MBA/MBA (T&HM))**

Current Affairs, General Knowledge, Business, Punch line of companies, Top officials of big companies, Major corporate events, Famous award and prizes, World Records, Books and authors, Science, History, Geography, International organizations, Important quotations, Social issues, Sports, Finance, Automobiles, Entertainment, Politics etc.

### **Computer Awareness (Only for MCA)**

Current Affairs, General Knowledge, Elements of computers, Number systems, Basic electronic gates, Boolean algebra, Flip-Flops. Systems, Programming and Operating System, Fundamentals of 'C' language



## M. Sc. Physics

### SECTION-A

#### Mathematical methods

Infinite sequences and series - convergence and divergence, conditional and absolute convergence, ratio test for convergence. Calculus of single and multiple variable, Partial derivatives, Jacobian, Imperfect and perfect differentials. Taylor Expansion. Vector algebra, Vector Calculus, Multiple integrals, Divergence theorem, Green's theorems, Stokes' theorem, Orthogonal coordinate systems. First order equations and linear second order differential equations with constant coefficients. Linear vector spaces, linear independence, basis. Matrices and determinants, Hermitian adjoint and inverse of a matrix; Hermitian, orthogonal, and unitary matrices; Eigenvalue and eigenvectors. Fourier expansion – statement of Dirichlet's condition, analysis of simple waveforms with Fourier series. Probability distributions and error analysis.

#### Classical mechanics and general properties of matter

Newton's laws of motion and applications, Velocity and acceleration in Cartesian, Polar and cylindrical coordinate systems. Uniformly rotating frame, Centrifugal and Coriolis forces. System of particles, Center of mass, Equation of motion of the CM, Conservation of linear and angular momentum, Conservation of energy, Variable mass systems Motion under a central force, Kepler's laws, Gravitational Law and field, Conservative and nonconservative forces Elastic and inelastic collisions. Differential equation for simple harmonic oscillator and its general solution, Superposition of two or more simple harmonic oscillators, Lissajous figures, Damped and forced oscillators, resonance, Wave equation, travelling and standing waves in one dimension, Energy density and energy transmission in waves, Group velocity and phase velocity, Sound waves in media, Doppler Effect. Rigid body motion, Euler angles, Fixed axis rotations. Moments of Inertia and products of Inertia, Parallel and perpendicular axes theorem, Principal moments and axes. Kinematics of moving fluids, Equation of continuity, Euler's equation, Bernoulli's theorem.

### SECTION-B

#### Optics

Fermat's Principle, General theory of image formation, Thick lens, Thin lens and lens combinations. Huygen's principle, Interference of light, Optical path retardation, interferometers. Fraunhofer diffraction, Rayleigh criterion and resolving power, Diffraction gratings. Linear, Circular and elliptic polarization, Double refraction and optical rotation. Lasers, principle and working.

#### Electricity and magnetism

Electricity and Magnetism: Coulomb's law, Gauss's law, Electric field and potential Electrostatic boundary conditions, Solution of Laplace's equation for simple cases. Conductors, Capacitors,

Dielectrics, Dielectric polarization Volume and surface charges, energy stored in Electromagnetic field Biot-Savart law, Ampere's law, Faraday's law of electromagnetic induction, Self and mutual inductance. Alternating currents, Simple DC and AC circuits with R, L and C components. Displacement current, Maxwell's equations and plane electromagnetic waves, Poynting's theorem. Lorentz Force and motion of charged particles in electric and magnetic fields. Reflection and refraction at a dielectric interface, Transmission and reflection coefficients.

## **SECTION-C**

### **Modern Physics**

Inertial frames and Galilean invariance, Postulates of special relativity, Lorentz transformations, Length contraction, Time dilation, Relativistic velocity addition theorem, Mass energy equivalence. Blackbody radiation, Planck's law, Rayleigh- Jeans and Wein's law, Photoelectric effect, Compton Effect. Bohr's atomic model, Sommerfeld's correction, X-rays. Wave-particle duality, Uncertainty principle. Wave function and its interpretation, wave packets, Dynamical variables as operators, measurement of observables, expectation values. Commutation relations between operators and compatibility, observables and simultaneous measurements, Ehrenfest's theorem. Schrödinger equation and its solution for one, two and three dimensional boxes, Solution of Schrödinger equation for the one dimensional harmonic oscillator, Reflection and transmission at a step potential.

### **Nuclear and Particle Physics**

General Properties of Nuclei, Nuclear Models: liquid drop model, condition of nuclear stability. Experimental evidence for nuclear magic numbers, elementary accounts of nuclear shell model and its predictions, Radioactivity, qualitative account of the theory of alpha decay and beta decay, Interaction of Nuclear Radiation with matter: Energy loss due to ionization energy loss of electrons, Cerenkov radiation, Rutherford scattering, multiple coulomb scattering, passage of gamma- rays through matter. Compton scattering, pair production radiation loss by fast electrons, Radiation length and electrongamma showers, positron annihilation, Relativistic Kinematics. Particles Accelerators and Detectors, classification of elementary particles, Types of interactions and its features, Mass spectra and major decays of elementary particle: leptons, mesons, baryons, Weak and electromagnetic Decays of Strange mesons and Hyperons. Classification of weak decays and selection rules.

## **SECTION-D**

### **Atomic and Molecular**

Spectroscopy Good quantum numbers and selection rules. Stern-Gerlach experiment, Fine structure. Magnetic moment of the electron, Lande g factor. Vector model – space quantization. Zeeman effect. Explanation from vector atom model. Pauli exclusion principle, shell structure. Hund's rule, spectroscopic terms of many electron atoms in the ground state, Spectra of alkali and alkaline earth atoms. Rotational and vibrational spectra, Raman effect, Stokes and anti-stokes lines, complimentary character of Raman and Infrared spectra, experimental arrangements for Raman spectroscopy.

## **Kinetic Theory of Gases and Thermodynamics**

Elements of Kinetic theory of gases. Velocity distribution and Equipartition of energy. Specific heat of Mono-, di- and tri-atomic gases. Ideal gas, van-der-Waals gas and equation of state. Mean free path. Laws of thermodynamics. Zeroth law and concept of thermal equilibrium. First law and its consequences. Isothermal and adiabatic processes. Reversible, irreversible and quasi-static processes. Second law and entropy. Carnot cycle. Maxwell's thermodynamic relations and simple applications. Thermodynamic potentials and their applications. Phase transitions and Clausius-Clapeyron equation. Ideas of ensembles, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distributions.

## **Solid State Physics and Electronics**

Basics of Crystal Structure: Lattice and basis, primitive and unit cell, Wigner Seitz cell, symmetry operations, lattice types, packing fraction, Miller indices, simple structures NaCl, diamond. Diffraction Methods: Bragg's Law, experimental arrangements, Laue equation, reciprocal lattice, atomic scattering factor, geometrical structure factors. Crystal bonding: Potential between a pair of atoms, LennardJones potential, Ionic, Covalent, Vander - Waal's, cohesive energy, Lattice Vibration, specific heat Einstein and Debye's models of specific heat. Free electron theory of metals, Band Theory of Metals: Kronig Penny model, Brillouin zones, electrons in periodic structure, energy bands, energy gaps, effective mass of electrons and holes, metals, insulators, semiconductors, Magnetism, Curie-Weiss law, Langevin theory, basics of superconductivity. Junction Diodes, Transistors their characteristics and simple circuit designs: Thevenin's Theorem, Norton Theorem, Constant Voltage and current generator, idea of equivalent circuits, low frequency equivalent circuits, h-parameters, bias stability, thermal runaway. BJT, FET's and MOSFETS: Structure and working, FET amplifier. Oscillators: Tuned Collector, Hartley and Colpitts oscillators, phase shift oscillators. Operational Amplifier, inverting noninverting amplifier, OP-Amp as adder, subtractor, comparator, integrator and differentiator. Modulation and detection, Digital electronics fundamentals, various number systems, Basic logic gates, de-Morgan's law

कर्मणि व्यञ्ज्यते प्रज्ञा

**Scheme of Syllabus for M.Sc Environmental****Section A:**

**Law of Motion**, Work, Energy and Power, Gravitation; Gas Laws, The First Law of Thermodynamics, Joule's Law, Specific Heats, Enthalpy, Adiabatic Processes; The Spectrum of Radiation, Blackbody Radiation, The Planck Function, Wien's Displacement Law, The Stefan-Boltzmann Law, Kirchhoff's Law, Beer's Law; Interaction of light with matter: Transmission, Absorption, Scattering; Beer-Lambert's Law; Atomic Absorption and Atomic Emission Spectra, X-Rays and Interaction of X-Rays with Matter. Single variable calculus: domain and range, maxima and minima, continuity, differentiability, integration; matrices and determinants; eigen values and eigenvectors; permutation and combination; ordinary differential equations with constant coefficients; analytic functions; groups and subgroups.

**Section B:**

**Microbes-diversity**, structure and reproduction. General account of infection, Phytoimmunology; Microbiology-Role in agriculture, industry, medicine and pollution combatment; Important plant diseases caused by viruses, bacteria, fungi and nematodes; Cryptogams and Gymnosperms-classification, distribution, diversity, structure and reproduction from evolutionary view point; Angiosperms- Systematics, anatomy, embryology, palynology and phylogeny; various systems of Classification; Non-chordata and chordates- General characters, nutrition, locomotion, reproduction of Protozoa, Coelenterata, Platyhelminthes, Nematelminthes, Annelida, Arthropoda, Mollusca, and Echinodermata, comparative study of Pisces, Amphibia, Reptilia and Mammalia; Cell and Molecular Biology-Techniques of Cell Biology, Prokaryotic and eukaryotic cells, Linkage and crossing over-methods of gene mapping including molecular maps; sex determination and molecular basis of sex differentiation, Mutations; Organic evolution; Ecology- Ecosystem structure and function of ecosystem, food chains, food webs and ecological succession; Ecological factors, Concepts and dynamics of community, Plant succession, Concepts of biosphere, Ecosystems and their conservation, Pollution, afforestation, deforestation and social forestry, Endangered plants, endemism and Red Data Books, Biodiversity- Convention of Biological Diversity and Conservation, Sovereign Rights and Intellectual Property Rights, Biogeochemical cycles.

**Section C :**

**Element and periodicity**, reaction mechanism, ionic, covalent and complex compounds , alkane, alkene , alkyne and aromatic compounds. Heterocyclic compounds, Homolytic and heterolytic fission , chemical kinetics. Environmental studies its scope and importance; Concept of sustainability and sustainable development. Natural Resources Renewable and Non-renewable Resources and its conservation; Environmental Pollution; Environmental Legislations - national and international ; Current environmental Issues- Climate change, global warming, ozonelayer depletion, acid rain and impacts on human communities and agriculture.

**Section D:**

**Modern theories on the origin of the Earth;** Internal structure of Earth; Theory of Plate tectonics and its implications in understanding mountain building and sea floor spreading processes; Folds and Faults; Natural hazards; Introduction to rocks and minerals. Different types of rocks and their characteristics; Rock-forming minerals; weathering and erosion of rocks and minerals; Geological Time Scale and associated geological events; Biogeochemical cycle; Physical work of river, wind, glacier, sea and lake; basic hydrology; engineering geology; environmental geology.

