

**UP Science Talent Search Examination 2016-2017****UPSTSE Syllabi****1. Syllabus for Class X Examination****MATHEMATICS SECTION****NUMBER SYSTEMS - REAL NUMBERS**

Euclid's division lemma, Fundamental Theorem of Arithmetic –

**ALGEBRA:****1. POLYNOMIALS**

- Zeros of a polynomial. Relationship between zeros and coefficients of quadratic polynomials. Statement and simple problems on division algorithm for polynomials with real coefficients.

**2. PAIR OF LINEAR EQUATIONS IN TWO VARIABLES**

- Pair of linear equations in two variables and graphical method of their solution, consistency/inconsistency.
- Algebraic conditions for number of solutions. Solution of a pair of linear equations in two variables algebraically - by substitution, by elimination and by cross multiplication method. Simple situational problems. Simple problems on equations reducible to linear equations.

**3. QUADRATIC EQUATIONS**

Standard form of a quadratic equation  $ax^2 + bx + c = 0$ , ( $a \neq 0$ ). Solutions of quadratic equations (only real roots) by factorization, by completing the square and by using quadratic formula. Relationship between discriminant and nature of roots. Situational problems based on quadratic equations related to day to day activities to be incorporated.

**4. ARITHMETIC PROGRESSIONS (8) Periods**

Motivation for studying Arithmetic Progression Derivation of the  $n^{\text{th}}$  term and sum of the first  $n$  terms of A.P. and their application in solving daily life problems.

**GEOMETRY****1. TRIANGLES**

- Definitions, examples, counter examples of similar triangles.
- (Prove) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
- (Prove) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.



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- (Prove) If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.
- (Motivate) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
- (Motivate) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.
- (Motivate) If a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse, the triangles on each side of the perpendicular are similar to the whole triangle and to each other.
- (Prove) The ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides.
- (Prove) In a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.
- (Prove) In a triangle, if the square on one side is equal to sum of the squares on the other two sides, the angles opposite to the first side is a right angle.

### 2. CIRCLES

- Tangent to a circle at, point of contact
- 1. (Prove) The tangent at any point of a circle is perpendicular to the radius through the point of contact.
- 2. (Prove) The lengths of tangents drawn from an external point to a circle are equal.

### 3. CONSTRUCTIONS

- 1. Division of a line segment in a given ratio (internally).
- 2. Tangents to a circle from a point outside it.
- 3. Construction of a triangle similar to a given triangle.

## TRIGONOMETRY

### 1. INTRODUCTION TO TRIGONOMETRY

- Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined); motivate the ratios whichever are defined at 0 degree and 90 degree. Values (with proofs) of the trigonometric ratios of 30, 45 and 60 degrees. Relationships between the ratios.

### 2. TRIGONOMETRIC IDENTITIES

- Proof and applications of the identity  $\sin^2 A + \cos^2 A = 1$ . Only simple identities to be given. Trigonometric ratios of complementary angles.

### 3. HEIGHTS AND DISTANCES : Angle of elevation, Angle of Depression.

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- Simple problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation / depression should be only  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ .

**STATISTICS AND PROBABILITY****1. STATISTICS**

- Mean, median and mode of grouped data (bimodal situation to be avoided). Cumulative frequency graph.

**2. PROBABILITY**

- Classical definition of probability. Simple problems on single events (not using set notation).

**COORDINATE GEOMETRY****1. LINES (In two-dimensions)**

**Review:** Concepts of coordinate geometry, graphs of linear equations. Distance formula. Section formula (internal division). Area of a triangle.

**MENSURATION****1. AREAS RELATED TO CIRCLES**

- Motivate the area of a circle; area of sectors and segments of a circle. Problems based on areas and perimeter / circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of  $60^\circ$ ,  $90^\circ$  and  $120^\circ$  only. Plane figures involving triangles, simple quadrilaterals and circle should be taken.)

**2. SURFACE AREAS AND VOLUMES**

(i) Surface areas and volumes of combinations of any two of the following: cubes, cuboids, spheres, hemispheres and right circular cylinders/cones. Frustum of a cone.

(ii) Problems involving converting one type of metallic solid into another and other mixed problems. (Problems with combination of not more than two different solids be taken.)

**CHEMISTRY SECTION- For Class X Examination**



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### Materials

#### Chemical Substances - Nature and Behaviour

**Chemical reactions:** Chemical equation, Balanced chemical equation, implications of a balanced chemical equation, types of chemical reactions: combination, decomposition, displacement, double displacement, precipitation, neutralization, oxidation and reduction.

**Acids, bases and salts:** Their definitions in terms of furnishing of  $H^+$  and  $OH^-$  ions, General properties, examples and uses, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

**Metals and non metals:** Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds; Basic metallurgical processes; Corrosion and its prevention.

**Carbon compounds:** Covalent bonding in carbon compounds. Versatile nature of carbon. Homologous series. Nomenclature of carbon compounds containing functional groups (halogens, alcohol, ketones, aldehydes, alkanes and alkynes), difference between saturated hydrocarbons and unsaturated hydrocarbons. Chemical properties of carbon compounds (combustion, oxidation, addition and substitution reaction). Ethanol and Ethanoic acid (only properties and uses), soaps and detergents.

**Periodic classification of elements:** Need for classification, Modern periodic table, gradation in properties, valency, atomic number, metallic and non-metallic properties.

## PHYSICS SECTION- For Class X Examination

### How Things Work

#### Effects of Current

Electric current, potential difference and electric current. Ohm's law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life. Heating effect of electric current and its applications in daily life. Electric power, Interrelation between P, V, I and R.

**Magnetic effects of current :** Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule. Electromagnetic induction. Induced potential difference, Induced current. Fleming's Right Hand Rule, Direct current. Alternating current : frequency of AC. Advantage of AC over DC. Domestic electric circuits.



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### Natural Resources

**Sources of energy:** Different forms of energy, conventional and non-conventional sources of energy: Fossil fuels, solar energy; biogas; wind, water and tidal energy; Nuclear energy. Renewable versus non-renewable sources of Energy. Conservation of natural resources.

Management of natural resources. Conservation and judicious use of natural resources. Forest and wild life; Coal and Petroleum conservation. Examples of people's participation for conservation of natural resources.

**Regional environment:** Big dams: advantages and limitations; alternatives, if any. Water harvesting. Sustainability of natural resources.

**Our environment:** Eco-system, Environmental problems, Ozone depletion, waste production and their solutions. Biodegradable and non-biodegradable substances.

### Natural Phenomena

Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (Derivation not required), magnification.

Refraction; Laws of refraction, refractive index.

Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification. Power of a lens; Functioning of a lens in human eye, defects of vision and their corrections, applications of spherical mirrors and lenses.

Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life.

## BIOLOGY SECTION- For Class X Examination

### World of Living

**Life processes:** 'Living Being'. Basic concept of nutrition, respiration, transport and excretion in plants and animals.

**Control and co-ordination in animals and plants:** Tropic movements in plants; Introduction of plant hormones; Control and co-ordination in animals: Nervous system; Voluntary, involuntary and reflex action; Chemical co-ordination: animal hormones.

**Reproduction:** Reproduction in animals and plants (asexual and sexual) reproductive health-need and methods of family planning. Safe sex vs HIV/AIDS. Child bearing and women's health.

**Heredity and Evolution:** Heredity; Mendel's contribution- Laws for inheritance of traits: Sex determination: brief introduction; Basic concepts of evolution.



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### 2. SYLLABUS FOR CLASS XII Examination

#### MATHEMATICS - For Class XII Examination

##### 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 relation. function; one-one, into and onto functions, composition of functions.

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

Complex numbers as ordered pair 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 coefficients, nature of roots, formation of quadratic equations with given root.

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

Matrices, algebra of matrices, type 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.



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### UNIT7: SEQUENCE AND SERIES:

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

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

Real - valued function, 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 normal.

### UNIT9: 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

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

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

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

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

### UNIT 10: DIFFERENTIAL EQUATIONS:



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Ordinary differential equation, 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.



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Probability: Probability of an event, addition and multiplication theorems of probability, Bayes' 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 - For Class XII Examination

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 I: 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.

#### UNIT3: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.



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### UNIT4: 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.

### UNIT5: 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.

### UNIT5: 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. Geostationary 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.



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### UNIT 10: OSCILLATIONS AND WAVES

Periodic motion-period, frequency, displacement as a function of time. Periodic functions. Simple harmonic motion (SHM) and its equation; phase; oscillations of a spring-restoring force and force constant; energy in SHM- 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



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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



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telescopes, Polarisation, plane polarized light; Brewster's law, uses of plane polarized light and Polaroids.

### **UNIT17: 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.

### **UNIT18: 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.

### **UNIT19: 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**

### **UNIT21: EXPERIMENTAL SKILLS**

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

1. Vernier calipers - 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.

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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 lensusing 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 curve 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.

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(iv) Check the correctness or otherwise of a given electronic component (diode, transistor or C).

**CHEMISTRY - For Class XII Examination****SECTION: A PHYSICAL CHEMISTRY****UNIT1: SOME BASIC CONCEPTS IN CHEMISTRY**

Matter and its nature. Dalton's atomic theory; Concept of atom, molecule, element and compound: Physical quantities and their measurement 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.

**UNIT2: 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. Calculation involving unit cell parameters, imperfection in solids: Electrical and magnetic properties.

**UNIT3: 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



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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; Rule 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.

### UNIT4: CHEMICAL BONDING AND MOLECULAR STRUCTURE

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

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, anti bonding), 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.

### UNIT6: SOLUTIONS



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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.

### UNIT7: 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; LeChatelier's principle. Ionic equilibrium: Weak and strong electrolytes, ionization of electrolytes, various concepts of acids and bases (Arrhenius, Bronsted - 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.

### UNIT8: 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: Kohlramsch'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.

### UNIT9: CHEMICAL KINETIS

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



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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 reaction (no derivation).

### UNIT 10: SURFACE CHEMISTRY

**Absorption** - 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, multi-molecular, 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 method) 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**



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General introduction, electronic configuration and general trend 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); Structure 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



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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 behavior, magnetic properties, complex formation, interstitial compounds, alloy formation: preparation, properties and uses of  $K_2Cr_2O_7$  and  $KMnO_4$ .

#### 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.

**UP Science Talent Search Examination 2016-2017****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



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alkylation and alkylation. 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, Halofom 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



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General introduction and importance 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, amiline 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 -  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{NH}_4^+$   
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.

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3. Preparation of lyophilic and lyophobic sols.

Kinetic study of reaction of iodide ion with hydrogen peroxide at room temperature.

**BIOLOGY - For Class XII Examination**

## Unit-I Reproduction

## Chapter-1: Reproduction in Organisms

Reproduction, a characteristic feature of all organisms for continuation of species; modes of reproduction - asexual and sexual reproduction; asexual reproduction - binary fission, sporulation, budding, gemmule formation, fragmentation; vegetative propagation in plants.

## Chapter-2: 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 dispersal and fruit formation.

## Chapter-3: Human Reproduction

Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis - spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

## Chapter-4: Reproductive Health

Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); 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

## Chapter-5: Principles of Inheritance and Variation



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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 and 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.

### Chapter-6: 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 and rice genome projects; DNA fingerprinting.

### Chapter-7: Evolution

Origin of life; biological evolution and evidences for biological evolution (paleontology, comparative anatomy, embryology and molecular evidences); 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**

### Chapter-8: Human Health and Diseases

Pathogens; parasites causing human diseases (malaria, dengue, chickengunia, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

### Chapter-9: Strategies for Enhancement in Food Production

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



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### Chapter-10: Microbes in Human Welfare

In household food processing, industrial production, sewage treatment, energy generation and microbes as biocontrol agents and biofertilizers. Antibiotics; production and judicious use.

## **Unit-IV Biotechnology and Its Applications**

Chapter-11: Biotechnology - Principles and processes Genetic Engineering (Recombinant DNA Technology).

### Chapter-12: Biotechnology and its Application

Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, bio piracy and patents.

## **Unit-V Ecology and Environment**

### Chapter-13: Organisms and Populations

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.

### Chapter-14: Ecosystem

Ecosystems: Patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy; nutrient cycles (carbon and phosphorous); ecological succession; ecological services - carbon fixation, pollination, seed dispersal, oxygen release (in brief).

### Chapter-15: Biodiversity and its Conservation

Concept of biodiversity; patterns of biodiversity; importance of biodiversity; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms,



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extinction, Red Data Book, biosphere reserves, national parks, sanctuaries and Ramsar sites.

### Chapter-16: 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 climate change; ozone layer depletion; deforestation; any one case study as success story addressing environmental issue(s).

#### A. List of Experiments

1. Study pollen germination on a slide.
2. Collect and study soil from at least two different sites and study them for texture, moisture content, pH and water holding capacity. Correlate with the kinds of plants found in them.
3. Collect water from two different water bodies around you and study them for pH, clarity and presence of any living organism.
4. Study the presence of suspended particulate matter in air at two widely different sites.
5. Study the plant population density by quadrat method.
6. Study the plant population frequency by quadrat method.
7. Prepare a temporary mount of onion root tip to study mitosis.
8. Study the effect of different temperatures and three different pH on the activity of salivary amylase on starch.
9. Isolate DNA from available plant material such as spinach, green pea seeds, papaya, etc.

#### B. Study/observation of the following (Spotting)

1. Flowers adapted to pollination by different agencies (wind, insects, birds).
2. Pollen germination on stigma through a permanent slide.
3. Identification of stages of gamete development, i.e., T.S. of testis and T.S. of ovary through permanent slides (from grasshopper/mice).



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4. Meiosis in onion bud cell or grasshopper testis through permanent slides.
  5. T.S. of blastula through permanent slides (Mammalian).
  6. Mendelian inheritance using seeds of different colour/sizes of any plant.
  7. Prepared pedigree charts of any one of the genetic traits such as rolling of tongue, blood groups, ear lobes, widow's peak and colour blindness.
  8. Controlled pollination - emasculation, tagging and bagging.
  9. Common disease causing organisms like *Ascaris*, *Entamoeba*, *Plasmodium*, Roundworm through permanent slides or specimens. Comment on symptoms of diseases that they cause.
  10. Two plants and two animals (models/virtual images) found in xeric conditions. Comment upon their morphological adaptations.
  11. Two plants and two animals (models/virtual images) found in aquatic conditions. Comment upon their morphological adaptations.
- C. Items for Identification/ familiarity with the apparatus for assessment in practicals (All experiments)
- Beaker, flask, petridishes, soil from different sites- sandy, clayey, bamy, small potted plants, aluminium foil, paint brush, test tubes, starch solution, iodine, ice cubes, Bunsen burner/water bath, large colourful flowers, Maize inflorescence, model of developmental stages highlighting morula and blastula of frog, beads of different shapes (cubes, round) /size, smooth and rough, tags of different shapes, bags, *Ascaris*, Cacti (*Opuntia*).
- D. List of Practicals
1. Study of the soil obtained from at least two different sites for their texture and water holding capacity.
  2. Study of presence of suspended particulate matter in air at two widely different sites.
  3. Study of the effect of different temperatures on the activity of salivary amylase.
  4. Study of flowers adapted to pollination by different agencies (wind, insects).
  5. Identification of T.S of morula or blastula of frog.
  6. Study of Mendelian inheritance pattern using beads of different colour/sizes.

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7. Preparation of pedigree charts of genetic traits such as rolling of tongue, colour blindness.
8. Study of emasculation, tagging and bagging by trying out an exercise on controlled pollination.
9. Identify common disease causing organisms like *Ascaris* and learn some common symptoms of the disease that they cause.
10. Comment upon the morphological adaptations of plants found in xerophytic conditions.