Academic Year 2021-2022

Shiv Nadar University Chennai Entrance Examination to B.Tech AI & Data Science and B.Tech CSE (IoT)

Syllabus for paper on Physics

1. Measurements, Laws of motion, Work, Energy and Power

Measurement of basic quantities –mass, length, time, measurement accuracies, measurement errors, error propagation

Law of conservation of linear momentum and its applications. static and kinetic friction - laws of friction, rolling friction, lubrication.

Work done by a constant force and a variable force; kinetic energy. work-energy theorem, power, conservation of kinetic and potential energies, non-conservative forces, elastic and inelastic collisions in one and two dimensions.

2. Properties of Matter

Elastic behaviour, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity, Poisson's ratio, elastic energy. Viscosity - Stokes' law. terminal velocity, streamline and turbulent flow - critical velocity. Bernoulli's theorem and its applications.

Heat - temperature, thermal expansion, thermal expansion of solids, specific heat capacity: C_p, C_v, latent heat capacity.

3. Electrostatics:

Charges and their conservation; Coulomb's law, forces between two point electric charges , forces between multiple electric charges-superposition principle, Electric field – electric field due to a point charge, electric field lines, electric dipole, electric field intensity due to a dipole , behaviour of a dipole in a uniform electric field, Electric potential - potential difference, electric potential due to a point charge and dipole, equipotential surfaces , electrical potential energy of a system of two point charges. Electric Flux-Gauss's theorem and its applications, electrostatic induction-capacitor and capacitance, dielectric and electric polarization, parallel plate capacitor with and without dielectric medium, applications of capacitor, energy stored in a capacitor, capacitors in series and in parallel.

4. Current Electricity:

Electric Current, flow of charges in a metallic conductor – drift velocity and mobility and their relation with electric current, Ohm's law, electrical resistance - V-I characteristics. electrical resistivity and conductivity-classification of materials in terms of conductivity, Carbon resistors – colour code for carbon resistors - combination of resistors, series and parallel, temperature dependence of resistance – internal resistance of a cell, potential difference and emf of a cell, combinations of cells in series and in parallel.

Kirchoff's laws, Wheatstone's Bridge and its application for temperature coefficient of resistance measurement, Metre bridge - special case of Wheatstone bridge, Potentiometer principle - comparing the emf of two cells, internal resistance of cell

5. Magnetism and Magnetic Effects of Current:

Magnetic properties – permeability, susceptibility, Classification of magnetic materials – dia, para and ferro magnetic materials, Concept of Hysteresis, Bar magnets, basic properties – magnetic dipole magnetic induction, potential energy of magnet in uniform field, Earth's magnetic field and magnetic elements

Magnetic effects of electric current – Biot Savart's law – Magnetic field due to current through circular loop, magnetic field due to infinitely long conductor, tangent law, tangent galvanometer deflection magnetometer Ampere's circuital law and its application. Force on a moving charge in uniform magnetic field and electric field cyclotron, Force on current carrying conductor in a uniform magnetic field, Forces between two parallel current carrying conductors, torque experienced by a current loop in a uniform magnetic field moving coil galvanometer, conversion of a galvanometer into voltmeter and ammeter, magnetic dipole moment of a revolving electron

6. Electromagnetic Induction and Alternating Current:

Electromagnetic induction - Faraday's law - induced emf and current - Lenz's law, Eddy currents, self-induction and mutual induction, electromotive force -methods of inducing emf, applications -AC generator - commercial generator. (Single phase, three phase). - transformer

Alternating currents-peak and RMS values, phasors and phase relationships in AC circuits - AC circuit with resistance, AC circuit with inductor, AC circuit with capacitor - LCR series circuit, resonance, power in AC circuits, wattless current

7. Optics:

Reflection of light, spherical mirrors, mirror formula. refraction of light, total internal reflection and its applications, optical fibers, refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula, magnification and power of a lens, combination of thin lenses in contact, combination of a lens and a mirror. Refraction and dispersion of light through a prism.

Wave front and Huygens's principle - Reflection, total internal reflection and refraction of plane wave at a plane surface using wave fronts. Interference - Young's double slit experiment and expression for fringe width - coherent source - interference of light - Formation of colours in thin films - Newton's rings. Diffraction - differences between interference and diffraction of light- diffraction grating.

8. Electromagnetic Waves and Dual Nature of Radiation and Matter:

Displacement current. Maxwell's correction to Ampere's circuital law, Maxwell's equation in integral form, sources of electromagnetic waves , electromagnetic spectrum , production and properties of electromagnetic waves – Hertz's experiment, Lenard's observations, Photoelectric effect - Einstein's photoelectric equation - laws of photoelectric emission, particle nature of light, Matter waves-wave nature of particles - de-Broglie relation

9. Atomic and Nuclear Physics:

Alpha-particle scattering experiment - Rutherford's model of atom - Bohr model - hydrogen spectrum.

Composition and size of nucleus-, mass defect, binding energy per nucleon and its variation with mass number, Radioactivity, alpha, beta and gamma decay and their properties; radioactive decay law, nuclear reactions-nuclear fission, nuclear reactors and fusion – hydrogen bomb –cosmic rays.

10. Semiconductor Electronics:

Energy bands in solids: classification into metals, semiconductors and insulators, intrinsic and extrinsic semiconductors, formation of PN junction, Diode V-I characteristics, diode applications as rectifier, voltage regulators, LED, solar cells –Junction transistor, characteristics –application as switch, amplifier, oscillator. Logic gates -NOT, OR, AND, EXOR, NAND and NOR - De Morgan's theorem - Laws and theorems of Boolean algebra.

Syllabus for paper on Chemistry

S.No	Topic	Content
1	Solid State	Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea). Unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties. Band theory of metals, conductors, semiconductors and insulators and n & p type semiconductors.
2	Solutions	Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties - relative lowering of vapour pressure, Raoult's law,

		elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties.
3	Electrochemistry	Redox reactions, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and law of electrolysis (elementary idea), dry cell -electrolytic cells and galvanic cells, lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and emf of a cell, corrosion.
4	Surface Chemistry	Absorption and Adsorption - physisorption and chemisorption, factors affecting adsorption of gases on solids and liquids. Catalysis: homogenous and heterogenous, activity and selectivity; enzyme catalysis. Colloidal state: distinction between true solutions, colloids and suspension; lyophilic, lyophobic multimolecular and macromolecular colloids; properties of colloids: Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsion - types of emulsions.
5	Chemical Kinetics	Rate of a reaction (Average and instantaneous), factors affecting rate of reaction: concentration, temperature, catalyst; order and molecularity of a reaction, rate law and specific rate

		constant, integrated rate equations and half-life (only for zero and first order reactions)
6	Principles and process of Isolation of Elements	Principles and methods of extraction - concentration, oxidation, reduction - electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.
7	Periodic Classification of Elements	Modern Periodic Table, Nomenclature of elements with atomic number >100, Grouping of elements based on electronic configuration. Variation of electronic configuration in the periods and groups. Periodic trends in properties: Atomic radius, ionic radius, ionisation energy, electron affinity and electronegativity. Periodic trends in chemical properties
8	p block elements	General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; Phosphorus - allotropic forms, compounds of phosphorus: preparation and properties of phosphine, halides PCl_3, PCl_5.
9	d and f block elements	General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals - metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties Lathanoids and Actinoids : Electronic configuration, oxidation states and their comparison

10	Coordination compounds	Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT, and CFT; structure and stereo isomerism, importance of coordination compounds (in qualitative inclusion, extraction of metals and biological system).
11	Basic Principles and Techniques in Organic chemistry	Introduction, Classification and nomenclature of organic compounds; IUPAC rules for naming organic compounds; structural representation; Isomerism – structural isomerism, stereo isomerism: Geometrical and optical isomerism, Detection and estimation of elements (C, H, N, S, X and P) in organic compounds; Purification of organic compounds – sublimation, crystallisation, distillation (fraction, steam and azeotropic), differential extraction
12	Organic compounds containing X, O and N	Haloalkanes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions. Haloarenes: Nature of C -X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only). Alcohols: Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses

		with special reference to methanol and ethanol.
		Phenols: Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.
		Ethers: Nomenclature, methods of preparation, physical and chemical properties, uses.
		Amines: Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.
13	Environmental Chemistry	Environmental pollution; Definition, Types – air, water and soil pollution- sources and effects
		Environmental Issues: Greenhouse effect, global warming, acid rain and ozone hole;
		Role of individuals to control pollutions
14	Biomolecules	Carbohydrates - Classification (aldoses and ketoses), monosaccahrides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen) importance.
		Proteins - Elementary idea of α - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only),

| | | denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure.

Vitamins - Classification and functions.

Nucleic Acids: : Basic units – Purine and Pyrimidine ,DNA-double helical structure, RNA –elementary idea only, differences between DNA and RNA |
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| 15 | Chemistry in everyday life | Chemicals in medicines - analgesics, tranquilizers antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

Chemicals in food – Role and examples of preservatives (Sodium Benzoate only), artificial sweetening agents (aspartame and Saccharin) |

Syllabus for paper on Mathematics

Sets –sets-relations & functions.

Trigonometry – Trigonometric functions, Trigonometric identities, Trigonometric equations, Properties of triangles, Inverse trigonometric functions.

Combinatorics – Permutation, Combinations, Principles of counting and Mathematical induction

Binomial Theorem – binomial theorem - Sequence and Series.

Basic algebra – Quadratic functions, polynomial functions, and linear Inequalities.

Two-dimensional Analytical Geometry – Straight Lines, tangent and normal, circles, ellipse, parabola, hyperbola – properties.

Vector algebra – Vector product & scalar product, product of three vectors, skew lines, planes.

Mathematical Logic – Logic, Contradiction, and contrapositive.

Complex numbers -complex form– conjugate, modulus – polar form.

Differential Calculus – Limits and Continuity, Differentiability, Lagrange's Mean Value theorem, Rolle's theorem, Maxima and Minima, Euler's theorem.

Integral Calculus – Evaluation- substitution, partial fractions, integration by parts. Definite integrals as a limit of a sum. Properties of definite integrals- Applications of integrals in finding area.

Matrices & determinants – matrices-types of matrices-Operations-Determinants – properties of determinants- consistency & inconsistency, solution of system of equations – inverse of a matrix- rank.

Probability – Probability Basics – conditional Probability – total probability – Baye's theorem – Random variable – Bernoulli Distribution and Binomial Distribution.

Differential equations – order, degree - Solution of homogenous equation of first order and first degree- Method of separation of variables.