VTUEEE Physics Syllabus 2025

1. Mechanics

Uniform and non-uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, Scalar, and vectors, relative velocity, Motion in a plane, projectile motion-uniform circular 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, the law of friction, rolling friction, basic concepts of rotational motion-moment of a force-torque, angular momentum, conservation of angular momentum and its application momentum 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.

2. Properties of matter

The universal law of gravitation, acceleration due to gravity, variation of 'g' with altitude, latitude and depth, gravitation potential – escape velocity and orbital velocity, geostationary satellites, Kepler's laws of planetary motion. Solids, elastic behaviour, stress-strain, Hooke's law, Moduli of elasticity, the relation between them, surface tension, capillarity, applications, viscosity, Poiseuille's formula, stokes law, applications, streamline and turbulent flow, Reynolds number, Bernoulli's theorem, application

3. Heat and thermodynamics

Equation of state of a perfect gas, work done on compressing a gas, Kinetic theory of gases, assumptions, the concept of pressure, Kinetic energy and temperature, RMS speed of gas molecules, degrees of freedom, the law of equipartition of energy, applications to specific heat capacities of gases, mean free path, Avogadro's number. Thermal Equilibrium, zeroth law of thermodynamics, the concept of temperature, heat, work and internal energy, the first law of thermodynamics, the Second law of thermodynamics, reversible and irreversible processes, the Carnot engine and its efficiency.

4. Optics

Reflection of light, spherical mirrors, mirror formula, Refraction of light, total internal reflection and its applications, refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula, Magnification, power of a lens, a combination of thin lenses in contact, a combination of a lens and a mirror, refraction, and dispersion of light through a prism, Scattering of light, the blue colour of the sky and reddish appearances of the sun at sunrise and sunset Wavefront and Huygens's principle, laws of reflection and refraction using Huygens's principle, interference, young's double-slit experiment and expression for fringe width, diffraction due to a slit, the width

of central maximum, resolving power of microscope and astronomical telescope, polarized light, Brewster's law, uses of plane-polarized light and Polaroid's.

5. Electricity

Electric Current, the 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, a combination of resistors, series and parallel, temperature dependence of resistance, the internal resistance of a cell, potential difference and emf of a cell, combinations of cells in series and parallel, Kirchoff's law, illustration by simple circuits, Wheatstone's Bridge and its application for temperature coefficient of resistance measurement, metre bridge, a special case of Wheatstone bridge, potentiometer principle, comparing the emf of two cells. Electromagnetic induction, Faraday's law, induced emf and current, Lenz's law, Self-induction, Mutual induction, self-inductance of a long solenoid, the mutual inductance of two long solenoids, Methods of inducing emf - (i) by changing magnetic induction (ii) by changing area enclosed by the coil and (iii) by changing the orientation of the coil (quantitative treatment), AC generator, commercial generator, (Single phase, three phase), Eddy current, applications, transformer, long-distance transmission, alternating current, measurement of AC, AC circuit with resistance, AC circuit with inductor, AC circuit with capacitor, LCR series resonance circuit, Q factor, power in AC circuits.

6. 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 ferromagnetic substances Magnetic susceptibility and permeability, hysteresis, electromagnets and permanent magnets.

7. Atomic physics

Atomic structure, the discovery of the electron-specific charge (Thomson's method) and charge of the electron (Millikan's oil drop method), alpha scattering, Rutherford's atom model, Bohr's model, energy quantization energy and wave number expressions, Hydrogen spectrum, energy level diagrams, sodium and mercury spectra, excitation and ionization potentials. Dual nature of radiation, photoelectric effect, hertz and Lenard's observations, Einstein's photoelectric equation, particle nature of light, matter-wave, wave nature of particle de Broglie relation, Davisson-Germer experiment.

8. Nuclear physics

Nuclear properties, nuclear radii, masses, binding energy, density, charge, isotopes, isobars and isotones, nuclear mass defect, binding energy, stability of nuclei, Bainbridge mass spectrometer, Nature of nuclear forces, Neutron and its discovery Radioactivity, alpha, beta and gamma rays and their properties, radioactivity decay law, mass-energy relation, mass defects, the binding energy per nucleon and its variation with mass number, nuclear fission and nuclear fusion.

9. Electronic devices

Semiconductors, semiconductor - diode, I-V characteristics in forward and reverse bias, diode as rectifier, I-V characteristics of LED, photodiode, solar cell and Zener diode, Zener diode as a voltage regulator, junction transistor, transistors action, characteristics of the transistor, transistor as an amplifier (common emitter configuration) and oscillator. Logic gates (OR, AND, NOT, NAND and NOR) transistor as a switch.

10. Laser and optic fibre

Interaction of radiation with matter, Essentials of Laser, Types of Laser - Ruby Laser, He-Ne Laser, semiconductor Laser, Application of Lasers, Optical Fibers – Propagation of light through an optical fibre, Modes of Propagation, Types of optical fibres, Optical fibre communication system, Attenuation in fibres.

VTUEEE Chemistry Syllabus 2025

1. Some basic concepts in chemistry

Matter and its nature, Dalton’s Atomic theory, the Concept of Atom, Molecule, element, and compound, Laws of chemical combination, Atomic and Molecular masses, Mole Concept, Molar mass, chemical equations, and Stoichiometry.

2. S Block, P Block, d block, f block elements

Group 1 and 2 elements, Electronic configuration, General methods in physical and Chemical properties of elements, anomalous properties of the first element of each Group, diagonal relationship P Block elements, Electronic configuration, 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. Structure, properties and uses of allotropes and oxides of Carbon, Silicon tetrachloride, Silicates, Zeolites and Silicones, Allotropic forms of Phosphorous, Structures of oxides and Oxoacids of nitrogen and phosphorous, Structures of oxo acids of Sulphur, Trends in the acidic nature of hydrogen halides, Structures interhalogen compounds and oxides and oxo acids of halogen D and f block elements, electronic configuration, general trends in properties of the first-row transition elements, ionization enthalpy, oxidation states, atomic radii, colour, Catalytic behaviour, magnetic properties, complex formation, interstitial

compounds, Lanthanides: electronic configuration, oxidation states Actinides: Electronic configuration, oxidation states.

3. Co-ordination Chemistry and Solid state Chemistry

IUPAC nomenclature of mononuclear coordination compounds, Isomerism, Geometrical isomerism in 4 Coordinate, 6 coordinate complexes, Theories of Coordination compounds-Werner's theory, Valence bond theory Lattice- unit cell, systems, types of crystals, packing in solids, ionic crystals, Imperfections in solids, point defects, X-ray diffraction, Electrical property, Amorphous, Crystalline

4. Thermodynamics, chemical equilibrium and chemical kinetics:

I and II law of thermodynamics, Spontaneous and non-spontaneous processes Entropy, Gibb's free energy, Free energy change and chemical equilibrium, Law of mass Action, Lechattlier's principle, applications of chemical equilibrium, Rate expression Order and Molecularity of reactions, Zero order, first order and Pseudo first order Reaction, half-life period, AArrheniusequation activation energy

5. Redox reactions and Electrochemistry

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

6. Purification and characterization of organic compounds

Purification- crystallization, sublimation, distillation, differential extraction and Chromatography - principles and their applications. Quantitative analysis, detection of nitrogen, sulfur, phosphorous, and halogens, Estimation of carbon, hydrogen, nitrogen, halogens, sulfur, and phosphorous. Calculations of empirical formulae, and molecular formulae, numerical problems in Organic quantitative analysis.

7. Some basic principles of organic chemistry

Tetra valency of carbon, shapes of simple molecules, hybridization (s & p), classification of organic compounds based on functional groups, and those containing halogen Oxygen, nitrogen, and Sulfur, Homologous series, isomerism,-Structural and stereo Isomerism. Electronic displacement in a covalent bond,- inductive effect, electrometric effect, Resonance and hyperconjugation, common types of organic reactions- substitution, Addition, elimination and rearrangement.

8. Hydrocarbons

Classification, isomerism, IUPAC nomenclature, general methods of Preparation, properties, and reactions, Alkanes, conformations: sawhorse and Newman projections (of ethane) Mechanism of electrophilic addition,, addition of hydrogen, halogens, water, hydrogen Halides, (Markownikoff's and peroxide effect) ozonalysis and polymerization Alkynes- acidic character, addition of hydrogen, halogens, water and hydrogen halides Polymerization.
Aromatic hydrocarbons- NNomenclature benzene, structure, and automaticity, Mechanism of electro philicubstitution, halogenations, nitration, Friedel Craft's Alkylation and acylation, directive influence of the functional group in mono substituted Benzene.

9. Organic compounds containing halogen

General methods of preparation, properties, and reactions, Nature of c-x bond, Mechanism of substitution reactions.

10. Organic compounds containing Oxygen

Alcohols, Phenols and ethers, identification of primary, secondary, and tertiary Alcohols, mechanism of dehydration, acidic nature of phenols, electrophilic Substitution reactions, halogenations nitration and sulphonation, Reimer TiemanbReaction, ethers- Structure Aldehydes and Ketones: Nature of carbonyl group, nucleophilic addition, > C = O group, relative reactivities of aldehydes, and ketones Important reactions such as –Nucleophilic addition Reactions (addition of HCN, NH3, and its derivatives) Grignard reagent, oxidation Reduction, acidit, Cannizzaro reaction, Haloform reaction, Chemical tests to Distinguish between aldehydes and Ketones 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.

11. Biomolecules

Carbohydrates-classification, aldoses and ketones, monosaccharides (glucose And fructose) and constituent monosaccharides of oligosaccharides (sucrose, lactose And maltose)Proteins-elementary idea of? –amino acids, peptide bond, polypeptide, proteins Primary, secondary, tertiary, and quaternary structure, denaturation of proteins, enzymes Vitamins-classification and functions.

12. Polymers

Classification, general methods of polymerization- addition and condensation Copolymerization, Natural and synthetic rubber, vulcanization, some important Polymers with emphasis on their monomers and uses-polythene, nylon, polyester and bakelite.

VTUEEE Mathematics Syllabus 2025

1. Partial fractions

Partial fractions of f(x)/g(x)when g(x) contains (i) non-repeated linear factors (ii) repeated and non-repeated linear factors; (iii) non-repeated irreducible quadratic factors; (iv) repeated and non-repeated irreducible quadratic factors.

2. Complex numbers

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.

3. Quadratic equations

Quadratic equations with real coefficients and their solutions (roots); the relation between the roots and the coefficients; nature of roots; formation of quadratic equations with given roots; simple problems.

4. Matrices and determinants

Matrices; algebra of matrices; types of matrices; symmetric and skew-symmetric matrices; orthogonal matrices; determinant of a square matrix; properties of determinants; evaluation of determinants; Test of consistency and solution of simultaneous linear equations in two and three unknowns.

5. Trigonometry

Trigonometric identities; trigonometric functions and inverse trigonometric functions and their properties.

6. Permutations and Combinations

Fundamental principles of counting; permutation as an arrangement and combination as a selection; meaning of npr and ncr simple problems.

7. Binomial theorem for a positive integral index

Binomial theorem for a positive integral index; general term and middle term; binomial coefficients and their properties; simple problems.

8. Two dimensional coordinate geometry

Cartesian system of rectangular coordinates in a plane; distance formula; section formula; locus and its equation; slope of a straight line; parallel and perpendicular lines; intercepts of a line on coordinate axes. Various forms of the equation of a line; point of intersection of two lines, angle between lines; distance of a point from a line; ortho centre, centroid and circumcenter of a triangle; equation of line passing through the point of intersection of two lines.
Equation of a circle; radius and centre; points of intersection of a straight line and a circle; equation of a tangent; condition for a line to be a tangent to a circle.

9. 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; equations of a line and a plane in different forms.

10. Vector algebra

Vectors and scalars; addition of vectors, components of a vector, scalar and vector products; angle between two vectors; parallel vectors; perpendicular vectors; scalar and vector triple products; coplanar vectors; unit normal vector.

11. Limit, continuity and differentiability

Real-valued functions; graphs of simple functions; limit of a function; continuity of a function at a point and in an interval; 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; applications of derivatives; monotonic functions; maxima and minima of functions of one variable.

12. Integration

Integral as anti-derivative; evaluation of integrals involving algebraic, trigonometric, exponential and logarithmic functions; integration by substitution; integration by parts; integration by partial fractions; Bernoulli rule; definite integrals and their properties; simple problems.

13. Ordinary differential equations

Order and degree; formation of differential equations; solution of differential equations by the method of separation of variables, solution of homogeneous differential equation; solution of linear differential equation of the type $dy/dx + P(x)\, y = Q(x)$.

14. Set theory & Probability

Sets and their representations; union, intersection and complements of sets; simple laws. Random experiment; sample space; event as a subset; Probability of an event; addition and multiplication theorems of probability; Bernoulli trials; Binomial distribution.