**According to session 2023-2024**

**[For all disciplines]**

**First Paper**

**[Physics, Chemistry, Mathematics, and English]**

Physics

**Measurement & Vector Quantities:** Principle of measurement, quantities & units, dimensions of units, scalar & vector quantities, vector representation, addition (subtraction) & resolutions of vectors, laws of triangle, dot & cross products.

**Motion & Force:** Classification of motion, displacement, speed, velocity, acceleration, retardation, projectile motion, equation of motion of a projectile, angular velocity & linear velocity, centripetal and centrifugal force, laws of falling bodies, force, Newton's laws of motion, resultant of parallel forces, inertia & momentum, principles of conservation of momentum, friction, coefficient of static friction, angle of repose, merits and demerits of friction, Kepler's law, gravity & gravitation, gravitational constant (G), acceleration due to gravity (g), mass & weight, gravitational potential & escape velocity.

**Work, Power & Energy:**Woik, power & energy, principle of the conservation of energy, potential energy (PE) & kinetic energy (KE), efficiency.

**Properties of Matter:** General and special properties of matter, elasticity & elastic limit, perfectly elastic body & perfectly rigid body, stress & strain, Hook’s law, various kinds of modulus of elasticity, Poisson’s ratio, pressure, characteristics of liquid pressure, surface tension & surface energy, angle of contact, Capillarity & theory of capillarity, Viscosity & co-efficient of viscosity.

**Waves, Oscillations & Sounds:** Periodic and simple harmonic motion (SHM), characteristics of SHM, simple pendulum & second pendulum, effective length, amplitude, phase, complete oscillation, period of oscillation, frequency, laws of simple pendulum, wave & wave motion, transverse wave & longitudinal wave, progressive & stationary waves, sound & production of sound, interference of

**Sound:** Constructive and Destructive interference, beats and Mechanism of formation of beats, infrasonic & Ultrasonic (supersonic) sound, velocity of sound, Compare the effects of pressure, temperature & humidity on the velocity of sound.

**Heat & Thermodynamics:**Heat & temperature, Celsius scale of temperature, mercury thermometer, specific heat capacity, thermal capacity, principle of calorimetry, specific latent heat, latent heat of fusion of ice & vaporization of water, specific heat of a solid, effect of heat on dimension of materials, differential expansion in bimetallic strip & thermostat, units co-efficient of linear, superficial and cubical expansion of solids, real and apparent expansion of liquid, methods of heat transfer by conduction, convection & radiation, thermal conductivity (K) & co-efficient of thermal conductivity, quantity of heat (Q) flowing through a material, Stefan-Boltzman Law, Wien’s law, Newton’s law of cooling, Green-house effect, standard Temperature and Pressure, humidity, absolute Humidity, relative humidity and dew-point, vapor pressure & air pressure, wet and dry bulb hygrometer, caloric theory and kinetic theory of heat, mechanical equivalent of heat, laws of thermodynamics, isothermal and adiabatic change, specific heat of a gas, molar specific heat or molar heat capacity, reversible process and irreversible process, entropy.

**Light:** light, photometry, luminous intensity, luminous flux, brightness & illuminating power, inverse square law of light, practical uses of light waves in engineering, mirror (plane & spherical), image (real & virtual) & magnification, reflection of light, laws of reflection of light, pole, principal axis, center of curvature, radius of curvature, principal focus in case of concave & convex mirrors, general equation of concave and convex mirror, refraction of light, absolute and relative refractive index, total internal reflection & critical angle, refraction of light through a prism, minimum deviation & angle of the prism, lens & uses of lens, general equation of lens (Concave & convex).

**Modern Physics:** Electrical conductivity of gases, discharge tube, cathode ray tube, X-ray, photo electric effect, Einstein’s photo electric equation, radio-activity, radio-active decay law., half-life & mean-life of radio-active atoms, nuclear fission and fusion. Space, time & Mass, rest mass, theory of relativity, special theory of relativity and its fundamental postulate, different kinds of theory of relativity, length contraction, time dilation, Einstein’s mass-energy relation.

**Chemistry**

**Atomic structure:** Define molecular mass, atomic number, mass number, mole and Aveogadro’s number, fundamental particle of atom, isotope, isobar and isotone, orbit and orbital, Rutherford's and Bohr's atomic model, quantum number, electronic configuration based on Aufbau principle, Hund’s rule and Pauli’s exclusion principle.

**Dalton's atomic theory & Avogadro's hypothesis:** Dalton's atomic theory, limitations of Dalton’s atomic theory, state Avogadro's hypothesis, Avogadro's constant, applications of Avogadro's hypothesis in Chemistry, problems using the knowledge of Avogadro's hypothesis.

**States of matter:** Basic properties of gases, Boyle’s law & Charle’s law, absolute temperature S.T.P/N.T.P, combine the gas laws to establish the gas equation (PV =nRT), Dalton’s law of partial pressure, problems in relation to pressure, volume, temperature and partial pressure of a mixture of gases.

**Periodic Table:** Introduction of modern periodic table and classification of elements, periodic change of properties of elements, oxides and hydroxides.

**Matter and its changes:** Define matter, element, compound, mixtures, solutions and suspensions, different types of reaction (exothermic and endothermic reactions), symbol and formula, valency of elements and radicals.

**Solution:** Ways of expressing concentration, molarity, molality, normality, solubility of completely miscible liquids, azeotropes, fractional distillation.

**Catalyst & Catalysis:** Types, criterion and important industrial uses, catalytic poison.

**Oxidation and Reduction:** Modern concepts of oxidation and reduction, oxidizing agent and reducing agents, oxidation number and oxidation state.

**Chemical bond:**Different types of bonds, ionic bond, covalent bond, polar covalent bond, co-ordinate bond, hydrogen bond, bonding theory (VBT).

**Acid, base and pH:** Modem concept of Acid and Base, properties of acid and base, pH scale and its uses, Buffer solutions and their mechanism, acid-base titration, indicators and their uses.

**Electrolysis:** Differentiate between electrical conductor and electrolyte, electrolysis process, electro- plating, galvanization, Faraday's laws of electrolysis, industrial applications of electrolysis.

**Water treatment:** Hard and soft water, advantage and disadvantage of soft and hard water, temporary and permanent hardness of water, permutit process to removal the hardness of water, reverse osmosis process.

**Important ores of Iron, Copper, Aluminum and Zinc:** Define (i) ores (ii) roasting (iii) calcination (iv) smelting (v) alloy (vi) slag, (vii) Flux, important ores of Iron, Copper, Aluminum and Zinc, manufacturing process of iron and copper from its ore, compare the properties of (i) Cast Iron (ii) Iron (iii) Steel (iv) Wrought Iron.

**Fundamental of Organic Compounds:** Distinguish between organic and inorganic compounds, homologous series of organic compounds and functional groups of organic compounds.

**Hydrocarbons:** Saturated and unsaturated hydrocarbons, general method of preparation and properties of alkane, alkene and alkynes as well as their [TUPAC system of nomenclature.

**Alcohol:** Classification of alcohol, Enzyme, Fermentation, De-carboxilation, Power alcohol and Absolute alcohol.

Mathematics

**Algebra:** Logarithms, AP & GP, Polynomial, Complex number, Permutation and Combination, Binomial theorem, Determinants, Matrix, Partial fractions, Exponential Series.

**Trigonometry:** Ratio of associated and compound angles, Transformation formulae, Multiple angle and Sub-multiple angles, Inverse circular functions, properties and solution of triangles.

**Co-ordinate Geometry:** Co-ordinates of a point, Locus and its equations, Straight lines, Circles and Conics.

**Differential Calculus:** Functions, Limits, Continuity, Differentiation, Successive Differentiation with Leibnitz theorern, Partial Differentiation.

**Integral Calculus:** Fundamental integrals, Integration by substitution, Integration by parts, partial fractions, Definite integrals.

English

**Uses of Tense:** Right form of verbs, correction of errors, subject-verb agreement in sentences, functional use of all kinds of tense.

**Sentence Structure:** Types of clauses and sentences, changing sentences according to the direction mentioned in brackets, completing sentences.

**Parts of Speech:**Identifying the usage of different types of parts of speech according to their place and function in a sentence.

**Use of Preposition:** Appropriate use of preposition, use of phrasal prepositions

**Idioms and Phrases:**Usage of idioms and phrases in written and verbal communication providing accurate meaning.

**Voice:** Change of voice from active to passive and vice versa.

**English Vocabulary:** Synonyms, antonyms, homophones, homographs, and homonyms.

**Reading:**Reading comprehension.

**Verbal:** Functional use of the main verb, gerund, infinitive, modals, and participles

**Translation:** Translation from Bengali to English and vice versa

**Punctuation and Capitalization:** Use of punctuation marks and capital letters appropriately in the sentence.

**Syllabus for Admission Test**

## Computer Science and Engineering

**Computer Fundamentals:** Basic Organization and Functional Units; Hardware, Software, Software and its applications.

**Basic Programming:** Basic program structure and IDE, pseudo code, header files, data types operators, variables and expressions; Input and Output; control statement and decision making, loop structure, arrays, strings, pointers, function, recursion, pointers and dynamic memory allocation, arrays, strings, multidimensional array; structures, unions enumerations, file I/O system, linking, library functions.

**Object Oriented Programming (C++/Python):** Object oriented programming basics, class & object, Propeities of object-oriented programming.

**Discrete Mathematics:** Probability theory, Counting, tree & graph.

**Data Structure:** Array, pointer, linked list, stack, queue, searching.

**Database Management:** Database system concept, data models, query languages.

**Software Development:** System analysis, system design, system implementation.

**Operating system:** Scheduling, memory management, I/O system, File system.

**Microprocessor & Microcomputer:** 8086 Architecture, bus systems, instruction sets, assembly language, interrupt control, interfacing chips, memories, secondary storage devices.

**Data Communication & Computer Network:** Transmission media, modulation/demodulation, Multiplexing, OSI and TCP/IP model, network topologies, network protocols, Internet, IP addressing.

**Computer Graphics:** Graphics pipeline, modeling, animation, rendering, relation to computer vision and image processing, geometric transformations, Rasterization.

**Digital Electronics:** Number systems, Boolean algebra, Logic gates, Combinational and sequential logic circuits, Flip-Flops, Registers, Counters, VLSI, AID and D/A Converters.

**Electronic Devices and Circuits:** Semiconductor Diodes and Rectifiers, BJT, JFET, MOSFET, CMOS, Amplifiers, Oscillator circuits, Photo Electric devices, Multi-vibrator, Time Base Circuits.

**Basic Electricity:**Circuit laws, DC circuits, AC circuits.