Entrance test Syllabus
for
B.Sc.(Hons.)-Computer (Data Science)

Scheme of Entrance Test

(i) Maximum marks: 90

(ii) There will be one set of Questions of 90 minutes duration in three parts as under:

Part-I : Mathematics **50 Questions** 50 Marks (1 to 50)
Part-II : Chemistry **20 Questions** 20 Marks (51-70)
Part-III: Physics **20 Questions** 20 Marks (71-90)

(iii) Only objective type/multiple-choice questions with one correct answer will be asked in the Entrance Test.

(iv) There will **'NOT'** be any Negative marking.

Part-I Mathematics:

Sets and binary operation: Sets and Function, binary operation, Inverse of an element in A. **Complex Number:** Complex number, algebra of complex number, real and imaginary parts of complex number, modulus and argument of complex number. **Quadratic Equations:** Solution of quadratic equation, relation between roots and coefficients, formation of equation symmetric function of roots. **Sequences And Series:** Arithmatic and geometric progression series. **Statistics:** Bargraph, Pie Chart, Median, Mean, Standard deviation. Mean deviation from mean and median. **Permutations And Combinations:** Permutations as arrangement, meaning of simple and applications including circular permutation. **Mathematical Induction And Binomial Theorem:** Mathematical Induction, Statement and proof of Binomial theorem for positive index. General and particular term of Binomial Theorem for any index. **Exponential And Logarithms Series:** The infinite series for e, Infinite series for log $(1+x)$ and log $(1+x)/(1-x)$. Calculation of the logarithm of a number using suitable logarithmic series. **Trigonometry:** Trigonometric equations, conditional identities, Sine formula, Cosine formula, area of triangle, simple solution of triangle using formulae, height and distance. **Co-Ordinate Geometry:** Distance formula, section formula, area of triangle, condition of co-linearity, centroid, In centre, locus parallel and perpendicular lines, formation of equation of straight lines in different forms. Intersection of two lines, condition for general second degree equation to represent two straight lines.

Circles, Equation of circle, parametric and diametric forms, point of intersection of a line and a circle, condition for a line to be tangent to a circle, equation and length of tangent to a circle form a point. Intersection of two circles. Conic Section, Equation of conic section and point of tangency. **Matrices And Determinants:** Matrix as a rectangular arrangement of numbers, type of matrices. Determinant, Minors and cofactors of determinant, expansion of a determinant, properties and elementary transformation of determinants. Crammer's rule, Adjoint and inverse of a matrix and its properties. **Vectors And Three Dimensional Geometry:** Vector, Magnitude and direction of a vector. Position vector of a point. Components of a vector, Vector in two and three dimensions, Algebra and application of vectors. Distance between two points, condition of the intersection of two lines, shortest distance between two lines. Distance of a point from the plane. Equation of a sphere in the form, Equation of sphere with the positions vectors as the extremities of a diameter in the form. **Differential Calculus:** Concept of real function, its domain and range, graphs of functions. Composition of functions, meaning of Fundamental theorems of limits. Derivative of function. Derivatives of x,x", sin x, cos x, tan x, theorems relating to the derivatives of the

sum, difference, product and quotient of functions, derivative of a function (chain rule), derivative of trigonometric functions, inverse trigonometric functions, logarithmic and exponential functions. Application of the derivative, motion in a straight line, motion under gravity, rate of change of quantities, increasing and decreasing functions and sign of the derivative, maxima and minima (absolute, local), Rolle's theorem, mean value theorem, curve sketching, meaning of differential, errors and approximations. **Integral Calculus:** Integration as the inverse of differentiation, Properties of integrals, Fundamental integrals involving algebraic, trigonometric and exponential functions, integration by substitution, integration by parts. **Definite Integral:** Fundamental theorem of calculus, evaluation of definite integrals, transformation of definite integrals by substitution, properties of definite integrals, evaluation of some definite integrals using the above properties. Definite integral and area bounded by a curve. **Differential Equations:** Differential equations, order and degree, formation of a differential equation, general and particular solution of a differential equation, solution of differential equation by the method of Variables Separable, Homogeneous equations and their solution, solution of the liner equation of first order with constant coefficients. **Correlation and Regression:** The concept of relationship between variables introduced as the dependence of conditional distribution on the values of the conditioning variable. Correlation analysis as the measurement of the strength of relationship between two quantitative variables and regression analysis as the method of predicting the values of one quantitative variable form those of the other quantitative variables. Definition and calculation of the correlation coefficient, positive and negative correlation, perfect correlation. Calculation of the regression coefficient and the two lines of regression by the method of least square. Use of the lines of regression for prediction, error of prediction and its relation with the coefficient correlation. **Probability:** Random experiment and the associated sample space (i.e. set of all outcomes), events as subjects of the sample space, occurrence of an event. Sure event, impossible event, mutually exclusive event, elementary event, equally likely elementary events. Definition of probability of an event as the ratio of the number of favourable equally likely events to the total number of equally likely events. Addition rule for mutually exclusive events. Combination of events through the operations (and, „not‟ and their set representation). Probability of the events "A" or "B", "Not A", conditional probability, Independent events, Independent experiments, Calculation of probabilities of events associated with independent experiments. Random variable, Distribution of a random variable.

Part-II Chemistry

Atomic Structure: Dual nature of matter and radiation, de Broglie equation, uncertainty principle, orbitals and quantum numbers, shapes of s, p and d orbitals, electronic configuration, atoms, molecules, molecular orbital method. **Periodic Properties Of Elements:** Modern periodic table, periodic trends in properties of elements. **Chemical Bonds And Molecules:** Chemical bonds (ionic, covalent, coordinate), hybridization, shapes of molecules (VSEPER theory), valence bond theory and molecular orbital theory, hydrogen bond, resonance, metallic bond. **Solid State:** Structure of simple ionic compounds, closepacked structures, ionic radii, properties of solids, amorphous and crystalline solids. **Chemical Thermodynamics:** Energy changes during a chemical reaction, First law, Second law and Third Law of Thermodynamics, enthalpy, entropy and chemical equilibrium. **Chemical Equilibrium:** Law of mass action, effect of concentration, pressure and temperature, Lechatelier principle, ionization of electrolytes, weak and strong electrolytes, various concepts of acids and bases, ionization of water, pH, solubility product. **Chemical Kinetics:** Rate of chemical reaction, rate expression, unit of rate constant and specific rate constant, order of reaction, concentration and temperature dependence of rate constant, fast reactions, mechanism of reactions, photochemical reactions. **Solutions:** Types of solutions, Raoult's law, colligative properties of dilute solutions. **Electrochemistry:** Electrolysis, electrolytic conductance, voltaic/galvanic cell, electrode potential and electromotive force, Gibb's free energy and cell potential, primary cells. **Surface And**

Catalysis: Colloids, emulsion, micelles, homogeneous and heterogeneous catalysis, theories of catalysis.
Nuclear Chemistry: Nature of radiation from radioactive substances, nuclear structure and nuclear properties, nuclear reactions, nuclear fission and fusion, isotopes and their uses, radio carbon dating.
Chemistry Of Representative Elements: The chemistry of s and p-block elements, electronic configuration, general characteristics, properties and oxidation states of the following: Group 1 Elements Alkali metals**;** Group 2 Elements Alkaline earth metals**;** Group 13 Elements Boron family**;** Group 14 Elements Carbon family**;** Group 15 Elements Nitrogen family**;** Group 16 Elements Oxygen family; Group 17 Elements Halogen family; Hydrogen**;** Group 18 Elements Noble gases. **Transition Metals Including Lanthanides:** Electronic configuration, oxidation states of transition metals, general properties of First row, second and third row transition elements, Preparation and uses of potassium dichromate, potassium permanganate, Inner transition elements : oxidation states, lanthanide contraction. **Coordinate Chemistry And Organo-Metallics:** Coordination compounds and their applications, bonding and stability in coordination compounds. **Chemistry Of Carbon Compounds: a) hydro carbons-** i) A brief study of Alkanes, Alkenes, Alkynes and their hybridization, isomerism and characteristic examples. ii) Arenes Delocalization of electrons in benzenes and resonance energy, orth, para and meta isomers. iii) Systematic nomenclature (compounds having carbon atoms upto six). iv) Properties and reactions of hydrocarbons: Change in physical properties with chain length, chemical properties, combustion and controlled oxidation, free radicals, halogenations, aromatization and cracking of alkanes. Properties of alkenes and alkynes, Markownikoff's rule. Reactions of benzene. v) Sources and synthesis of hydrocarbons: Refining of petroleum, reforming, octane number, pyrolysis of coal. **b) characterization of organic compounds**-Detection of elements, calculation of empirical and molecular formulae from weight percentage data of elements and molecular weight. **c) alkyl and aryl halides**- Nomenclature, isomerism, optical isomerism, racemic mixture, general methods of preparation and properties of alkyl and aryl halides, chloroform, carbon tetrachloride, DDT, benzene hexachloride. **d) compounds with functional groups containing oxygen and nitrogen**- Nomenclature, isomerism, general methods of preparation and properties of ethers, aldehydes, ketones, carboxylic acids and their derivatives (acyl halides, acid anhydrides, amides and esters); cyanides and isocynides, nitro compounds and amines and their methods of preparation and uses.
Polymers: Classification of polymers, Natural and synthetic polymers, Preparation and uses of Teflon, PVC, Polystyrene, Nylon-66, Terylene. **Biomolecules:** Monosaccharides, Disaccharides, Polyaccharides Amino acids and Peptides-structure and classification, Proteins and Enzymes-structure of proteins, Nucleic Acids - DNA and RNA, Protein synthesis and replication. Lipids-structure, membranes and their functions.
Chemistry Of Biological Processes: Carbohydrates and their metabolism, Haemoglobin, blood and respiration, Immune System, Vitamins and hormones, simple idea of Chemical evolution.

Part-III PHYSICS
Introduction: What is Physics? Physics in relation to science and technology.
Physical World & Measurement: Unit for measurement and derived units, dimensions, order of magnitude, accuracy and errors in measurement. **Description Of Motion In One Dimension:** Objects in motion, motion in one dimension. Motion in a straight line, uniform motion. General relation between position and velocity, application to uniformly accelerated motion. **Description Of Motion In Two And Three Dimensions:** Vectors and scalars, vector addition and multiplication by a real number, zero vector and its properties. Motion in two dimensions, uniform velocity and uniform acceleration, uniform circular motion, motion of objects in three-dimensional space. **Laws Of Motion:** Force and inertia. First law, Second law and Third law of motion, rocket propulsion, equilibrium of concurrent forces. Laws of friction, rolling friction, lubrication, inertial and non-inertial frames. **Work, Energy And Power:** Work done by a constant and a variable force, Work, kinetic energy, power, Elastic collisions, Different forms of energy, mass-energy equivalence, conservation of energy. **Rotational Motion:** Newton's law of motion, torque, angular momentum, conservation of angular momentum, examples of circular motion, comparison of linear and rotational motions, properties of moment of inertia, parallel axis theorem, examples of two dimensional rigid body motion. **Gravitation:** Acceleration due to gravity, onedimensional and two dimensional motion

under gravity, universal law of gravitation, variations in the acceleration due to gravity of the earth, geo-stationary satellites, gravitational potential, escape velocity. **Molecules:** Atomic hypothesis, Brownian motion, Avogadro's number and Avogadro's hypothesis. Inter-atomic and inter-molecular forces. States of matter. **Properties Of Matter:** (A) **Solids**: Crystalline and glassy solids, Hooke's Law, Young's modulus, stress vs. strain, bulk modulus, (B) **Fluids**: Surface energy and surface tension, capillary rise, viscosity, streamline flow, Reynold's number. Bernoulli's theorem. (C) **Gases** : Boyle's law, Charle's law and absolute temperature. Kinetic theory of gases. Pressure, kinetic energy and temperature, gas laws. **Heat And Thermodynamics:** Mechanical equivalent of heat, specific heat, first law of thermodynamics, pressure-temperature phase diagram, heat engines, second law of thermodynamics. Conduction, convection and radiation. **Oscillations:** Simple harmonic motion (S.H.M.), uniform circular motion. Kinetic energy and potential energy in S.H.M., simple pendulum, forced oscillations, resonance and damped oscillations.
Waves: Wave motion, speed of wave motion, principles of superposition, reflection of waves, harmonic waves, standing waves, and normal modes, beats, Doppler effect, musical scale, acoustics of buildings.
Electrostatics: Coulomb's law, dielectric constant, electric field due to a point charge, dipole, dipole field and dipole" s behaviour in an electric field, flux, conductors and insulators, presence of free charges and bound charges inside a conductor, Capacitance, energy of capacitor, Van de Graff generator.. **Current Electricity:** Electric current, resistance and resistivity, colour code for carbon resistances,
Ohm's law, Kirchoff's law, resistance in series and parallel circuits, Wheatstone's bridge, measurement of voltages and currents, concept of e.m.f., terminal voltage and internal resistance of a cell. **Thermal And Chemical Effects Of Currents:** Electric power, Heating effects of current, chemical effects and law of electrolysis, cells (primary and secondary), thermoelectricity, thermocouple.
Magnetic Effects Of Currents: Oersted's observation, Biot-Savart law, magnetic field due to a straight wire, circular loop and solenoid, force on a moving charge in a magnetic field (Lorentz force), cyclotron, forces and torques on current in a magnetic field, force between two currents, Moving coil galvanometer.
Magnetism: Bar magnet (comparison with a solenoid), line of force, torque on a bar magnet in a magnetic field, Earth's magnetic field, tangent galvanometer, vibration magnetometer, para, dia and ferromagnetism.
Electromagnetic Induction And Alternating Currents: Faraday's law, Lenz's law, induction and inductance, alternating currents, impedance and reactance, power in a.c. circuits with L, C & R; series and parallel resonant circuits, electrical machines and devices, transformer, a.c. generator, choke and starter.
Electromagnetic Waves: Electromagnetic oscillation, history of e.m. waves, electromagnetic spectrum with their applications and uses. **Ray Optics And Optical Instruments:** Sources of light, Photometry, ray optics as a limiting case of wave optics, reflection, total internal reflection, curved mirrors, lenses, dispersion by a prism, spectrometer and spectra, absorption and emission, scattering, rainbow, telescope, microscope. **Wave Optics:** Wave front and Huygen's principle, interference - Young's double slit experiment. Diffraction due to a single slit, diffraction grating, polarization of transverse waves, application related to these phenomena. **Electrons And Photons:** Electrical conduction of gases, electron, photon, Einstein's photoelectric equation, photocells. **Atoms, Molecules And Nuclei:** Rutherford model of atom, Bhor model, energy quantization, hydrogen spectrum, composition of nucleus, atomic masses, isotopes, size of nucleus, radioactivity, mass-energy relation, fission, fusion, nuclear holocaust. **Solids And Semi-Conductor Devices:** Conductors, insulators and semi-conductors, p-n junction diodes, solar cells, junction transistor, diode as rectifier, transistor as amplifier and oscillator, logic gates. **Universe:** The constituents of the universe, planets, stars, brightness, magnitude scale, luminosity, surface temperature, stellar spectra, energy source of stars.