

Syllabus for PUCAT-2023

Syllabus for B.Sc. (Zoology, Botany, Chemistry, Environmental Science, Physics, Maths, Chemistry, Geology, Microbiology), B.Sc. (Hons.) Biotechnology, B.Sc. (Hons.) Environmental Science.

Question paper consists of 100 MCQs. 30 questions from physics, 30 questions from chemistry and 40 questions from Mathematics or Biology. All Parts are compulsory. Time: 2 Hr.

Biology

Diversity of Living Organisms

The Living World What is living? Biodiversity; Need for classification; three domains of life; concept of species and taxonomical hierarchy; binomial nomenclature.

Biological Classification Five kingdom classification; Salient features and classification of Monera, Protista and Fungi into major groups; Lichens, Viruses and Viroids.

Plant Kingdom Salient features and classification of plants into major groups - Algae, Bryophyta, Pteridophyta and Gymnospermae. (salient and distinguishing features and a few examples of each category).

Animal Kingdom Salient features and classification of animals, non-chordates up to phyla level and chordates up to class level (salient features and distinguishing features of a few examples of each category). (No live animals or specimen should be displayed.)

Structural Organization in Animals and Plants

Morphology of Flowering Plants Morphology of inflorescence and flower, Description of 01 family: Solanaceae or Liliaceae (to be dealt along with the relevant experiments of the Practical Syllabus).

Structural Organization in Animals Animal tissues.

Cell: Structure and Function

Cell-The Unit of Life Cell theory and cell as the basic unit of life, structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles - structure and function; endomembrane system, endoplasmic reticulum, golgi bodies, lysosomes, vacuoles, mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); nucleus.

Biomolecules Chemical constituents of living cells: biomolecules, structure and function of proteins, carbohydrates, lipids, nucleic acids; Enzymes- types, properties, enzyme action.

Cell: Structure and Function

Cell Cycle and Cell Division Cell cycle, mitosis, meiosis and their significance

Plant Physiology

Photosynthesis in Higher Plants Photosynthesis as a means of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and biosynthetic phases of photosynthesis; cyclic and non-cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C₃ and C₄ pathways; factors affecting photosynthesis.

Respiration in Plants Exchange of gases; cellular respiration - glycolysis, fermentation (anaerobic), TCA cycle and electron transport system (aerobic); energy relations - number of ATP molecules generated; amphibolic pathways; respiratory quotient.

Plant - Growth and Development Growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA.

Human Physiology

Breathing and Exchange of Gases Respiratory organs in animals (recall only); Respiratory system in humans; mechanism of breathing and its regulation in humans - exchange of gases, transport of gases and regulation of respiration, respiratory volume; disorders related to respiration - asthma, emphysema, occupational respiratory disorders.

Body Fluids and Circulation Composition of blood, blood groups, coagulation of blood; composition of lymph and its function; human circulatory system - Structure of human heart and blood vessels; cardiac cycle, cardiac output, ECG; double circulation; regulation of cardiac activity; disorders of circulatory system - hypertension, coronary artery disease, angina pectoris, heart failure.

Excretory Products and their Elimination Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system – structure and function; urine formation, osmoregulation; regulation of kidney function - renin - angiotensin, atrial natriuretic factor, ADH and diabetes insipidus; role of other organs in excretion; disorders - uremia, renal failure, renal calculi, nephritis; dialysis and artificial kidney, kidney transplant.

Locomotion and Movement Skeletal muscle, contractile proteins and muscle contraction.

Neural Control and Coordination Neuron and nerves; Nervous system in humans - central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse.

Chemical Coordination and Integration Endocrine glands and hormones; human endocrine system - hypothalamus, pituitary, pineal, thyroid, parathyroid, adrenal, pancreas, gonads; mechanism of hormone action (elementary idea); role of hormones as messengers and regulators, hypo - and hyperactivity and related disorders; dwarfism, acromegaly, cretinism, goiter, exophthalmic goiter, diabetes, Addison's disease.

Reproduction

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.

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).

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).

Genetics and Evolution

Principles of Inheritance and Variation 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 human being, 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.

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, Human and rice genome projects; DNA fingerprinting.

Biology and Human Welfare

Human Health and Diseases Pathogens; parasites causing human diseases (malaria, dengue, chikungunya, 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.

Microbes in Human Welfare Microbes in food processing, industrial production, sewage treatment, energy generation and microbes as bio-control agents and bio-fertilizers. Antibiotics; production and judicious use. Unit-IX Biotechnology and its Applications Chapter-11:

Biotechnology - Principles and Processes Genetic Engineering (Recombinant DNA Technology).

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, biopiracy and patents.

Ecology and Environment

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.

Biodiversity and its Conservation Biodiversity - Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, Sacred Groves, biosphere reserves, national parks, wildlife, sanctuaries and Ramsar sites.

Physics

Physical World and Measurement

Physical World: Physics- scope and excitement, nature of physical laws, Physics, technology and society

Units and Measurements: Need for measurement, Units of measurement, Length, mass and time measurements, systems of units, SI units, fundamental and derived units, errors in measurement, significant figures, Dimensions of physical quantities, accuracy and precision of measuring instruments, dimensional analysis and its applications

Kinematics

Motion in a Straight Line: 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, Relations for uniformly accelerated motion, velocity-time and position-time graphs, Elementary concepts of differentiation and integration for describing motion

Motion in a Plane: Scalar and vector quantities, general vectors and their notations, equality of vectors, position and displacement vectors, multiplication of vectors by a real number, addition and subtraction of vectors, relative velocity, Unit vector, rectangular components, Scalar and Vector product of vectors, resolution of a vector in a plane, Motion in a plane, cases of uniform velocity and uniform acceleration, projectile motion, uniform circular motion

Laws of Motion

Intuitive concept of force, Equilibrium of concurrent forces, Inertia, Newton's first, second and third law of motion, momentum, impulse, Law of conservation of linear momentum and its applications, Centripetal force, examples of circular motion, Static and kinetic friction, laws of friction, rolling friction, lubrication, Dynamics of uniform circular motion

Work, Energy and Power

Work done by a constant force and a variable force, kinetic energy, motion in a vertical circle, work-energy theorem, power, elastic and inelastic collisions in one and two dimensions, Notion of potential energy, potential energy of a spring, conservative forces, conservation of mechanical energy, non-conservative forces

Motion of System of Particles and Rigid Body

Centre of mass of a two-particle system, momentum conservation and centre of mass motion, Centre of mass of rigid body, rigid body rotation and equations of rotational motion, centre of mass of uniform rod, Equilibrium of rigid bodies, Moment of force, torque, angular momentum, law of conservation of angular momentum and its applications, comparison of linear and rotational motions, Moment of inertia, values of moments of inertia for simple geometrical objects, Statement of parallel and perpendicular axes theorems and their applications, radius of gyration

Gravitation

Kepler's laws of planetary motion, universal law of gravitation, Gravitational potential energy and gravitational potential, Acceleration due to gravity and its variation with altitude and depth, escape velocity, Geo-stationary satellites, orbital velocity of a satellite

Properties of Bulk Matter

Mechanical Properties of Solids: Elastic behaviour, Hooke's law, Stress-strain relationship, bulk modulus, Young's modulus, shear modulus of rigidity, Poisson's ratio, elastic energy

Mechanical Properties of Fluids: Pressure due to a fluid column, Pascal's law and its applications, Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, critical velocity, effect of gravity on fluid pressure, application of surface tension ideas to drops, Bernoulli's theorem and its applications, Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, bubbles and capillary rise

Thermal Properties of Matter: Heat, temperature, thermal expansion, thermal expansion of solids, liquids and gases, specific heat capacity, Wein's displacement Law, Stefan's law, C_p , C_v - calorimetry, change of state- latent heat capacity, Heat transfer-conduction, convection and radiation, qualitative ideas of Blackbody radiation, anomalous expansion of water, thermal conductivity, Greenhouse effect

Thermodynamics

Thermal equilibrium and definition of temperature, zeroth law, heat, work and internal energy, isothermal and adiabatic processes, Laws of thermodynamics, reversible and irreversible processes, Heat engine and refrigerator

Behaviour of Perfect Gases and Kinetic Theory of Gases

Equation of state of a perfect gas, concept of mean free path, work done in compressing a gas, Kinetic interpretation of temperature, Kinetic theory of gases- assumptions, concept of pressure, Avogadro's number, RMS speed of gas molecules, degrees of freedom, law of equi-partition of energy and application to specific heat capacities of gases

Oscillations and Waves

Oscillations: Periodic motion, time period, frequency, displacement as a function of time, periodic functions, Simple harmonic motion (S.H.M) and its equation, energy in S.H.M., phase, oscillations of a loaded spring- restoring force and force constant, Kinetic and potential energies, Free, forced and damped oscillations, simple pendulum derivation of expression for its time period, resonance

Waves: Wave motion, speed of travelling wave, Transverse and longitudinal waves, displacement relation for a progressive wave, fundamental mode and harmonics, Beats, principle of superposition of waves, reflection of waves, Doppler effect, standing waves in strings and organ pipes

Units and Measurements

Need for measurement: Units of measurement; systems of units; SI units, fundamental and derived units. significant figures. Dimensions of physical quantities, dimensional analysis and its applications.

Motion in a Straight Line

Frame of reference, Motion in a straight line, Elementary concepts of differentiation and integration for describing motion, uniform and non-uniform motion, and instantaneous velocity, uniformly accelerated motion, velocity - time and position-time graphs. Relations for uniformly accelerated motion (graphical treatment).

Motion in a Plane

Scalar and vector quantities; position and displacement vectors, general vectors and their notations; equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors, Unit vector; resolution of a vector in a plane, rectangular components, Scalar and Vector product of vectors. Motion in a plane, cases of uniform velocity and uniform acceleration- projectile motion, uniform circular motion.

Laws of Motion

Intuitive concept of force, Inertia, Newton's first law of motion; momentum and 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, lubrication. Dynamics of uniform circular motion: Centripetal force, examples of circular motion (vehicle on a level circular road, vehicle on a banked road).

Work, Energy and Power

Work done by a constant force and a variable force; kinetic energy, work- energy theorem, power. Notion of potential energy, potential energy of a spring, conservative forces: non- conservative forces, motion in a vertical circle; elastic and inelastic collisions in one and two dimensions.

System of Particles and Rotational Motion

Centre of mass of a two-particle system, momentum conservation and Centre of mass motion. Centre of mass of a rigid body; centre of mass of a uniform rod. Moment of a force, torque, angular momentum, law of conservation of angular momentum and its applications. Equilibrium of rigid bodies, rigid body rotation and equations of rotational motion, comparison of linear and rotational motions. Moment of inertia, radius of gyration, values of moments of inertia for simple geometrical objects (no derivation).

Gravitation

Kepler's laws of planetary motion, universal law of gravitation. Acceleration due to gravity and its variation with altitude and depth. Gravitational potential energy and gravitational potential, escape velocity, orbital velocity of a satellite.

Mechanical Properties of Solids

Elasticity, Stress-strain relationship, Hooke's law, Young's modulus, bulk modulus, shear modulus of rigidity (qualitative idea only), Poisson's ratio; elastic energy.

Mechanical Properties of Fluids

Pressure due to a fluid column; Pascal's law and its applications (hydraulic lift and hydraulic brakes), effect of gravity on fluid pressure. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, critical velocity, Bernoulli's theorem and its simple applications. Surface energy and surface tension, angle of contact, excess of pressure across a curved surface, application of surface tension ideas to drops, bubbles and capillary rise.

Thermal Properties of Matter

Heat, temperature, thermal expansion; thermal expansion of solids, liquids and gases, anomalous expansion of water; specific heat capacity; C_p , C_v - calorimetry; change of state - latent heat capacity.

Heat transfer-conduction, convection and radiation, thermal conductivity, qualitative ideas of Blackbody radiation, Wein's displacement Law, Stefan's law .

Thermodynamics

Thermal equilibrium and definition of temperature zeroth law of thermodynamics, heat, work and internal energy. First law of thermodynamics, Second law of thermodynamics: gaseous state of matter, change of condition of gaseous state -isothermal, adiabatic, reversible, irreversible, and cyclic processes.

Kinetic Theory

Equation of state of a perfect gas, work done in compressing a gas. Kinetic theory of gases - assumptions, concept of pressure. Kinetic interpretation of temperature; rms speed of gas molecules; degrees of freedom, law of equi-partition of energy (statement only) and application to specific heat capacities of gases; concept of mean free path, Avogadro's number.

Oscillations

Periodic motion - time period, frequency, displacement as a function of time, periodic functions and their application. Simple harmonic motion (S.H.M) and its equations of motion; phase; oscillations of a loaded spring- restoring force and force constant; energy in S.H.M. Kinetic and potential energies; simple pendulum derivation of expression for its time period.

Waves

Wave motion: Transverse and longitudinal waves, speed of travelling 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.

Chemistry

Some Basic Concepts of Chemistry: General Introduction: Importance and scope of Chemistry. Atomic and molecular masses, mole concept and molar mass, percentage composition, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry.

Structure of Atom: Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals - Aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

Classification of Elements and Periodicity in Properties: Modern periodic law and the present form of periodic table, periodic trends in properties of elements - atomic radii, ionic radii, inert gas radii, Ionization enthalpy, electron gain enthalpy, electronegativity, valency. Nomenclature of elements with atomic number greater than 100.

Chemical Bonding and Molecular Structure: Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules(qualitative idea only), Hydrogen bond.

Redox Reactions: Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions - in terms of loss and gain of electrons and change in oxidation number.

Hydrogen: Position of hydrogen in periodic table, occurrence, isotopes, hydrides ionic, covalent and interstitial; physical and chemical properties of water, heavy water, hydrogen as a fuel.

Organic Chemistry: Some basic Principles and Techniques: General introduction, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electromeric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions.

States of Matter: Gases and Liquids: Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws in elucidating the concept of the molecule, Boyle's law, Charles law, Gay Lussac's law, Avogadro's law, ideal behaviour, empirical derivation of gas equation, Avogadro's number, ideal gas equation and deviation from ideal behaviour.

Chemical Thermodynamics: Concepts of System and types of systems, surroundings, work, heat, energy, extensive and intensive properties, state functions. First law of thermodynamics -internal energy and enthalpy, measurement of ΔU and ΔH , Hess's law of constant heat summation, enthalpy of bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution. Second law of Thermodynamics (brief introduction) Introduction of entropy

as a state function, Gibb's energy change for spontaneous and non-spontaneous processes. Third law of thermodynamics (brief introduction).

Equilibrium: Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium - Le Chatelier's principle, ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of poly basic acids, acid strength, concept of pH, buffer solution, solubility product, common ion effect (with illustrative examples).

s -Block Elements: Group 1 and Group 2 Elements -General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens, uses.

Some p -Block Elements: General Introduction to p -Block Elements Group 13 Elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group, Boron - physical and chemical properties. Group 14 Elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first elements. Carbon - catenation, allotropic forms, physical and chemical properties.

Hydrocarbons: Classification of Hydrocarbons Aliphatic Hydrocarbons: Alkanes - Nomenclature, isomerism, conformation (ethane only), physical properties, chemical reactions. Alkenes - Nomenclature, structure of double bond (Ethene), geometrical isomerism, physical properties, methods of preparation, chemical reactions:- addition of Hydrogen, Halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), Ozonolysis, Oxidation, mechanism of electrophilic addition. Alkynes - Nomenclature, structure of triple bond (Ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of - hydrogen, halogens, hydrogen halides and water.

Aromatic Hydrocarbons: Introduction, IUPAC nomenclature, benzene: resonance, aromaticity, chemical properties: mechanism of electrophilic substitution. Nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation, directive influence of functional group in monosubstituted benzene. Carcinogenicity and toxicity.

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.

Solutions: Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, Raoult's law, colligative properties - relative lowering of vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties.

p Block Elements: Group -15 Elements: General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; Nitrogen preparation properties and uses; compounds of Nitrogen: preparation and properties of Ammonia and Nitric Acid. Group 16 Elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties, dioxygen: preparation, properties and uses, classification of Oxides, Ozone, Sulphur -allotropic forms; compounds of Sulphur: preparation properties and uses of Sulphur-dioxide, Sulphuric Acid: properties and uses; Oxoacids of Sulphur (Structures only). Group 17 Elements: General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens, Preparation, properties and uses of Chlorine and Hydrochloric acid, interhalogen compounds, Oxoacids of

halogens (structures only). Group 18 Elements: General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

Haloalkanes and Haloarenes: Haloalkanes: Nomenclature, nature of C–X bond, physical and chemical properties, optical rotation mechanism of substitution reactions. **Haloarenes:** Nature of C–X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only). **Alcohols, Phenols and Ethers: Alcohols:** Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration. **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.

Biomolecules: Carbohydrates - Classification (aldoses and ketoses), monosaccharides (glucose and fructose), D-L configuration. **Proteins** -Elementary idea of - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins. **Nucleic Acids:** DNA and RNA

Mathematics

Sets: Empty set, Finite and Infinite sets, Equal sets, Subsets, Power set, Universal set, Venn diagrams. Union and Intersection of sets. Difference of sets. Complement of a set. Properties of Complement. Ordered pairs. Cartesian product of sets. Number of elements in the Cartesian product of two finite sets.

Relations & Functions: Definition of relation, domain, co-domain and range of a relation. Types of relations: reflexive, symmetric, transitive and equivalence relations. Function as a special type of relation. Domain, co-domain and range of a function. Types of functions. Sum, difference, product and quotients of functions.

Trigonometric Functions: Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Domain and range of trigonometric functions and their graphs. Trigonometric identities. General solution of trigonometric equations. Definition and elementary properties of inverse trigonometric functions.

Algebra: Principle of mathematical induction and simple applications. Permutations and Combinations with simple applications. Binomial theorem. Pascal's triangle, General and middle term in binomial expansion, simple applications.

Complex Numbers and Quadratic Equations-- Algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Statement of Fundamental Theorem of Algebra. Solutions of quadratic equations (with real coefficients) in the complex number system. Square root of a complex number.

Matrices-- Concept, notation, order, equality, types of matrices. Operations on matrices. Concept of elementary row and column operations. Invertible matrices (Here all matrices will have real entries).

Determinants-- Determinant of a square matrix and properties of determinants. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

Linear Inequalities-- Solutions of linear inequalities in one variable as well as in two variables.

Sequence and Series-- Definitions of sequence and series. Arithmetic Progression (A. P.). Arithmetic Mean (A.M.). Geometric Progression (G.P.). Geometric Mean (G.M.). Simple applications regarding A.P. and G.P.

Coordinate Geometry:

Straight Lines-- Various forms of equations of a line, slope of a line and angle between two lines.

Distance of a point from a line.

Conic Sections-- Circle, ellipse, parabola, hyperbola, a point, a straight line and a pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of circle, parabola, ellipse and hyperbola.

Introduction to Three-dimensional Geometry-- Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

Calculus:

Limit, Continuity and Derivative-- Concept of limit of a function, Definitions of Continuity and differentiability of a function. Algebra of limits of functions, continuous functions and derivatives of functions. Chain rule. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretation. Applications of limits, continuity and derivatives.

Integrals-- Integration as inverse process of differentiation. Integration of a variety of functions. Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

Applications of the Integrals-- Applications in finding the area under simple curves, especially lines, circles/ parabolas/ellipses (in standard form only), Area between any of the two above said curves (the region should be clearly identifiable).

Differential Equations-- Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given. Solution of differential equations by method of separation of variables, solutions of homogeneous differential equations of first order and first degree

Vectors and Three-Dimensional Geometry:

Vectors and Scalars-- Definition of a vector and also of a scalar. Direction cosines and direction ratios of a vector. Types of vectors, position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Properties and applications of scalar (dot) product of vectors, vector (cross) product of vectors, and scalar triple product of vectors.

Three-dimensional Geometry-- Direction cosines and direction ratios of a line joining two points. Cartesian equation and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes, (iii) a line and a plane. Distance of a point from a plane.

Linear Programming: Introduction, related terminology such as constraints, objective function, optimization, different types of linear programming (L.P.) problems, mathematical formulation of L.P. problems, graphical method of solution for problems in two variables, feasible and infeasible regions (bounded or unbounded), feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

Statistics and Probability:

Statistics-- Measures of Dispersion: Range, Mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances. **Probability--** Random experiments; outcomes, sample spaces (set representation). Events; occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive events, Axiomatic (set theoretic) probability, connections with other theories of earlier classes. Probability of an event, probability of 'not', 'and' and 'or' events. Conditional probability, multiplication theorem on probability, independent events, total probability, Bayes' theorem, Random variable and its probability distribution, mean and variance of random variable. Binomial probability distribution.

Master of Business Administration

A common paper for MBA, MBA(Business Economics), MBA(Finance & Control), MBA(e-Commerce), MBA(Agri-Business), MBA (HRD) will come in the entrance examination of PUCAT-2023. Question paper consists of 100 MCQs. All questions are compulsory. Time: 2 Hr.

Section A

English Language Grammar Vocabulary Uncommon words Sentence completion Synonyms Antonyms Relationship between words & phrases Comprehension of passages

Section B

Numerical Aptitude Numerical calculation Arithmetic Simple algebra Geometry and trigonometry Interpretation of graphs Charts and tables.

Section C

Thinking and Decision Making Creative thinking unfamiliar relationships Verbal reasoning finding patterns trends Assessment of figures & diagrams

Section D

General Awareness Knowledge of current affairs other issues related to trade, industry, economy, sports, culture and science

D. Pharm

Syllabus for D. Pharm entrance exam in PUCAT-2023 comprises Physics, Chemistry, and Biology/Mathematics of Intermediate level. Question paper consists of 100 MCQs (35 questions of Physics, 35 Questions of Chemistry and 30 Questions of Biology & 30 Questions of Mathematics). All questions of Physics and Chemistry are compulsory and candidates should solve either of Biology or Mathematics questions. Time: 2 Hr.

- 1. Physics:-** Units and measurements, motion in a straight line, motion in a plane, laws of motion, work, energy and power, system of particles and rotational motion, gravitation, mechanical properties of solids, thermal properties of fluids, thermodynamics, kinetic theory, oscillations, waves, electric charges and fields, electrostatic potential and capacitance, current electricity, moving charges and magnetism, magnetism and matter, electromagnetic induction, alternating current, electromagnetic waves, ray optics, dual nature of radiation, atoms, nuclei, semiconductor electronics: materials, devices and simple circuits.
- 2. Chemistry :-** Basic concepts of chemistry, structure of atoms, classification of elements and periodicity in properties, chemical bonding and molecular structure, states of matter, thermodynamics, equilibrium, redox reactions, s-block elements, p-block elements, d and f- block elements, hydrocarbons, environmental chemistry, the solid state, solutions, electrochemistry, chemical kinetics, surface chemistry, general principles and processes of isolation of elements, coordination compounds, haloalkanes, alcohols, phenols and ethers, aldehydes, ketones, and carboxylic acids, amines, biomolecules, polymers, chemistry in everyday life.
- 3. Biology:-** The living world, biological classification, plant kingdom, animal kingdom, morphology of flowering plants, anatomy of flowering plants, structural organisation in animals, Cell, biomolecules, cell cycle and cell division, transport in plants, mineral nutrition, photosynthesis, respiration, plant growth and development, digestion and absorption, breathing and exchange of gases, body fluids and circulation, excretory products and their elimination, locomotion and movement, neural control and coordination, chemical coordination and integration, reproduction in organism, sexual reproduction in flowering plants, principles of inheritance and variation, molecular basis of inheritance, evolution, human health and diseases, microbes in human welfare, biotechnology and its application, organisms and populations, ecosystems, biodiversity and conservation, environmental issues.
- 4. Mathematics:-** Relations and functions, inverse trigonometric functions, matrices, determinants, continuity and differentiability, application of derivatives, integrals, application of integrals, differential equation, vector algebra, three dimensional geometry, linear programming, probability, sets, complex numbers and quadratic equations, linear inequalities, permutations and combinations, binomial theorem, sequence and series, conic sections, limits and derivatives, statistics, mathematical reasoning.

Bachelor of Computer Applications

Syllabus for BCA entrance exam in PUCAT-2023 comprises of Arithmetic Aptitude, Logical reasoning, Computer Awareness, English language and General Knowledge & Current Affairs. **Question paper consists of 100 MCQs and divided into five section. Each section has equal number of questions. All questions are Compulsory. Time:2 Hr.**

- 1. Arithmetic Aptitude-** Percentage , Profit and Loss, Calendar problem, Simplification, Average, Problem on Trains, Time and work, Probability, Simple & compound Interest, Problems on Ages, Clock, Volume and Surface Area, Ratio.
- 2. Reasoning-** Odd man out, Analogy, Letter and Symbol Series, Letter and Symbol Series, Blood Relation, Logical Problems, Statement and Conclusion, Artificial Language, Data Sufficiency
- 3. Computer Awareness** – Introduction, Generation of computers, Operating system, History of Computer, Input/output devices, Hardware & Software, Computer networks, Data Processing, Computer Memory.
- 4. General English-** One Word Substitution, Synonyms, Antonyms, Grammar, Idioms and Phrases, Ordering of Words, Ordering of Sentences, Sentence Completion, Punctuation, Article.
- 5. General Knowledge & Current Affairs-** Knowledge of Current Affairs and other issues related to Trade, Industry, Economy, Govt. Program, , National /International days, Sports, Culture and Science, Awards and Honours, Famous Personalities, World Rankings, Annul Reports of International Organizations/Institutions, Geography, History, Awards and Honours, Inventions.

Master of Computer Applications

Syllabus for MCA entrance exam in PUCAT-2023 consists of 100 MCQs. All questions are Compulsory. Time: 2 Hr.

Thinking and Decision Making:

- Creative thinking, unfamiliar relationships, verbal reasoning, finding patterns trends and Assessment of figures & diagrams.
- Geometrical designs & Identification
- Selection of related letters / words / numbers / figures
- Identification of odd thing / item out from a group
- Completion of numerical series based on the pattern / logic
- Fill in the blanks of the series based on the numerical pattern and logic of the series
- Syllogisms (logic based questions), Identification of logic & selection of correct answers based on the logic

Mathematics:

- Set Theory: Concept of sets – Union, Intersection, Cardinality, Elementary counting; permutations and combinations. • Probability and Statistics: Basic concepts of probability theory, Averages, Dependent and independent events, frequency distributions, measures of central tendencies and dispersions.
- Algebra: Fundamental operations in algebra, expansions, factorization, simultaneous linear /quadratic equations, indices, logarithms, arithmetic, geometric and harmonic progressions, determinants and matrices.
- Coordinate Geometry: Rectangular Cartesian coordinates, distance formulae, equation of a line, and intersection of lines, pair of straight lines, equations of a circle, parabola, ellipse and hyperbola. Calculus: Limit of functions, continuous function, differentiation of function, tangents and normal, simple examples of maxima and minima. Integration of functions by parts, by substitution and by partial fraction, definite integrals, applications of definite integrals to areas.
- Vectors: Position vector, addition and subtraction of vectors, scalar and vector products and their applications to simple geometrical problems and mechanics.
- Trigonometry: Simple identities, trigonometric equations, properties of triangles, solution of triangles, heights and distances, general solutions of trigonometric equations.

Computer Awareness:

- Computer Basics: Organization of a computer, Central Processing Unit (CPU), structure of instructions in CPU, input/output devices, computer memory, and back-up devices.
- Data Representation: Representation of characters, integers and fractions, binary and hexadecimal representations, binary arithmetic: addition, subtraction, multiplication, division, simple arithmetic and two's complement arithmetic, floating point representation of numbers, Boolean algebra, truth tables, Venn diagrams.

B.Com (Hons.)

Syllabus for B.Com (Hons) entrance exam in PUCAT-2023 comprises of Basic Mathematics, Business Organization, Business Management, Accountancy, Financial Statement Analysis, Financial Markets, Economics, Money and Banking, Business Environment, General English Computer Basics Current Economic Affairs and Reasoning. **Question paper consists of 100 MCQs. All questions are Compulsory. Time: 2 Hr.**

B.A. LLB (Hons.)

Syllabus for B.A. LLB (Hons.) entrance exam in PUCAT-2023 consists of 100 MCQs. All questions are Compulsory. Time: 2 Hr.

A.Language Comprehension

(i) Hindi-10 questions,

10 marks

(ii) English-20 questions

20 marks

B.(i) Reasoning, Mental Ability-20 questions

20 marks

And (ii) Legal Aptitude-20 questions 20 marks

C. General Awareness and Current Affairs-30 questions

30 marks

Total-100 (Multiple Choice Questions) 100 marks