



BITSAT

What is BITSAT?

BITSAT stands for the Birla Institute of Technology and Science Admission Test. Candidates seeking an admission in the on-campus undergraduate engineering courses offered at any of the three campuses of Birla Institute of Technology and Science (BITS) Pilani appear for BITSAT. The three campuses of BITS Pilani are located at Pilani, Goa and Hyderabad.



BITSAT is conducted every year by BITS Pilani by which the deserving candidates are given admission into BITS Pilani's B.E., B.Pharm and M.Sc. programmes.

BITSAT 2024 Syllabus: The authorities will prepare and release the BITSAT 2024 syllabus online on the official website at bitsadmission.com. Via the BITSAT syllabus 2024, candidates will be able to know the details regarding the subjects, units, and topics that have to be studied for the entrance examination.

The syllabus of BITSAT 2024 comprises five subjects - Physics, Chemistry, Mathematics/ Biology (BPharma), English Proficiency and Logical Reasoning

BITSAT Syllabus 2024

Candidates can check the subject-wise BITSAT 2024 syllabus below.

✓ BITSAT 2024 Physics Syllabus

**Topics Units & Measurement**

- Units (Different systems of units, SI units, fundamental and derived units)
- Dimensional Analysis
- Precision and significant figures
- Fundamental measurements in Physics (Vernier calipers, screw gauge, Physical balance etc)

Kinematics

- Properties of vectors
- Position, velocity and acceleration vectors
- Motion with constant acceleration
- Projectile motion
- Uniform circular motion
- Relative motion

Newton's Laws of Motion

- Newton's laws (free body diagram, resolution of forces)
- Motion on an inclined plane
- Motion of blocks with pulley systems
- Circular motion – centripetal force
- Inertial and non-inertial frames

Impulse and Momentum

- Definition of impulse and momentum
- Conservation of momentum
- Collisions
- Momentum of a system of particles
- Center of mass

Work and Energy



- Work done by a force
- Kinetic energy and work-energy theorem
- Power
- Conservative forces and potential energy
- Conservation of mechanical energy

Rotational Motion

- Description of rotation (angular displacement, angular velocity and angular acceleration)
- Rotational motion with constant angular acceleration
- Moment of inertia, Parallel and perpendicular axes theorems, rotational kinetic energy
- Torque and angular momentum
- Conservation of angular momentum
- Rolling motion

Gravitation

- Newton's law of gravitation
- Gravitational potential energy, Escape velocity
- Motion of planets – Kepler's laws, satellite motion

Mechanics of Solids and Fluids

- Elasticity
- Pressure, density and Archimedes' principle
- Viscosity and Surface Tension
- Bernoulli's theorem

Oscillations

- Kinematics of simple harmonic motion
- Spring mass system, simple and compound pendulum
- Forced & damped oscillations, resonance

**Waves**

- Progressive sinusoidal waves
- Standing waves in strings and pipes
- Superposition of waves, beats
- Doppler Effect

Heat and Thermodynamics

- Kinetic theory of gases
- Thermal equilibrium and temperature
- Specific heat, Heat Transfer - Conduction, convection and radiation, thermal conductivity, Newton's law of cooling Work, heat and first law of thermodynamics
- Second law of thermodynamics, Carnot engine – Efficiency and Coefficient of performance

Electrostatics

- Coulomb's law
- Electric field (discrete and continuous charge distributions)
- Electrostatic potential and Electrostatic potential energy
- Gauss' law and its applications
- Electric dipole
- Capacitance and dielectrics (parallel plate capacitor, capacitors in series and parallel)

Current Electricity

- Ohm's law, Joule heating
- DC circuits – Resistors and cells in series and parallel, Kirchoff's laws, potentiometer, and Wheatstone bridge
- Electrical Resistance (Resistivity, origin and temperature dependence of resistivity)

Magnetic Effect of Current

- Biot-Savart's law and its applications



- Ampere's law and its applications
- Lorentz force, force on current-carrying conductors in a magnetic field
- Magnetic moment of a current loop, torque on a current loop
- Galvanometer and its conversion to voltmeter and ammeter

Electromagnetic Induction

- Faraday's law, Lenz's law, eddy currents
- Self and mutual inductance
- Transformers and generators
- Alternating current (peak and rms value)
- AC circuits, LCR circuits

Optics

- Laws of reflection and refraction
- Lenses and mirrors
- Optical instruments – telescope and microscope
- Interference – Huygen's principle, Young's double slit experiment
- Interference in thin films
- Diffraction due to a single slit
- Electromagnetic waves and their characteristics (only qualitative ideas), Electromagnetic spectrum
- Polarisation – states of polarization, Malus' law, Brewster's law

Modern Physics

- Dual nature of light and matter – Photoelectric effect, De Broglie wavelength
- Atomic models – Rutherford's experiment, Bohr's atomic model
- Hydrogen atom spectrum
- Radioactivity
- Nuclear reactions: Fission and fusion, binding energy

Electronic Devices



- Energy bands in solids (qualitative ideas only), conductors, insulators and semiconductors
- Semiconductor diode – I-V characteristics in forward and reverse bias, diode as a rectifier; I-V characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator.
- Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator
- Logic gates (OR, AND, NOT, NAND and NOR)
- Transistor as a switch

✓ BITSAT 2024 Chemistry Syllabus

Topics	
States of Matter	<ul style="list-style-type: none">• Measurement: Physical quantities and SI units, Dimensional analysis, Precision, Significant figures.• Chemical reactions: Laws of chemical combination, Dalton's atomic theory; Mole concept; Atomic, molecular and molar masses; Percentage composition empirical & molecular formula; Balanced chemical equations & stoichiometry• Three states of matter, intermolecular interactions, types of bonding, melting and boiling points Gaseous state: Gas Laws, ideal behavior, ideal gas equation, empirical derivation of gas equation, Avogadro number, Deviation from ideal behaviour – Critical temperature, Liquefaction of gases, van der Waals equation.• Liquid state: Vapour pressure, surface tension, viscosity.• Solid state: Classification; Space lattices & crystal systems; Unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell – Cubic & hexagonal systems; Close packing; Crystal structures: Simple AB and AB₂ type ionic crystals, covalent crystals – diamond & graphite, metals. Voids, number of atoms per unit cell



Topics	
	<p>in a cubic unit cell, Imperfections- Point defects, non-stoichiometric crystals; Electrical, magnetic and dielectric properties; Amorphous solids – qualitative description. Band theory of metals, conductors, semiconductors and insulators, and n- and p-type semiconductors.</p>
Atomic Structure	<ul style="list-style-type: none"> • Introduction: Subatomic particles; Atomic number, isotopes and isobars, Thompson's model and its limitations, Rutherford's picture of atom and its limitations; Hydrogen atom spectrum and Bohr model and its limitations. • Quantum mechanics: Wave-particle duality – de Broglie relation, Uncertainty principle; Hydrogen atom: Quantum numbers and wavefunctions, atomic orbitals and their shapes (s, p, and d), Spin quantum number. • Many electron atoms: Pauli exclusion principle; Aufbau principle and the electronic configuration of atoms, Hund's rule.
Periodicity: Brief history of the development of periodic tables Periodic law and the modern periodic table; Types of elements: s, p, d, and f blocks; Periodic trends: ionization energy, atomic, and ionic radii, inter gas radii, electron affinity, electro negativity and valency. Nomenclature of elements with atomic number greater than 100. Chemical Bonding & Molecular Structure	<ul style="list-style-type: none"> • Valence electrons, Ionic Bond: Lattice Energy and Born-Haber cycle; Covalent character of ionic bonds and polar character of covalent bond, bond parameters • Molecular Structure: Lewis picture & resonance structures, VSEPR model & molecular shapes • Covalent Bond: Valence Bond Theory- Orbital overlap, Directionality of bonds & hybridization (s, p & d orbitals only), Resonance; Molecular orbital theory- Methodology, Orbital energy level diagram, Bond order, Magnetic properties for homonuclear diatomic species (qualitative idea only). • Dipole moments; Hydrogen Bond.



Topics	
Thermodynamics	<ul style="list-style-type: none"> • Basic Concepts: Systems and surroundings; State functions; Intensive & Extensive Properties; Zeroth Law and Temperature • First Law of Thermodynamics: Work, internal energy, heat, enthalpy, heat capacities and specific heats, measurements of ΔU and ΔH, Enthalpies of formation, phase transformation, ionization, electron gain; Thermochemistry; Hess's Law, Enthalpy of bond dissociation, combustion, atomization, sublimation, solution and dilution • Second Law: Spontaneous and reversible processes; entropy; Gibbs free energy related to spontaneity and non-spontaneity, non-mechanical work; Standard free energies of formation, free energy change and chemical equilibrium • Third Law: Introduction
Physical and Chemical Equilibria	<ul style="list-style-type: none"> • Concentration Units: Mole Fraction, Molarity, and Molality • Solutions: Solubility of solids and gases in liquids, Vapour Pressure, Raoult's law, Relative lowering of vapor pressure, depression in freezing point; elevation in boiling point; osmotic pressure, determination of molecular mass; solid solutions, abnormal molecular mass, van't Hoff factor. Equilibrium: Dynamic nature of equilibrium, law of mass action • Physical Equilibrium: Equilibria involving physical changes (solid-liquid, liquid-gas, solid-gas), Surface chemistry, Adsorption, Physical and Chemical adsorption, Langmuir Isotherm, Colloids and emulsion, classification, preparation, uses. • Chemical Equilibria: Equilibrium constants (K_P, K_C), Factors affecting equilibrium, Le-Chatelier's principle. • Ionic Equilibria: Strong and Weak electrolytes, Acids and Bases (Arrhenius, Lewis, Lowry and Bronsted) and their dissociation; degree of ionization, Ionization



Topics	
	<p>of Water; ionization of polybasic acids, pH; Buffer solutions; Henderson equation, Acid-base titrations; Hydrolysis; Solubility Product of Sparingly Soluble Salts; Common Ion Effect.</p> <ul style="list-style-type: none"> • Factors Affecting Equilibria: Concentration, Temperature, Pressure, Catalysts, Significance of ΔG and ΔG^0 in Chemical Equilibria.

✓ BITSAT 2024 Mathematics Syllabus

Topics	
Algebra	<ul style="list-style-type: none"> • Complex numbers, addition, multiplication, conjugation, polar representation, properties of modulus and principal argument, triangle inequality, roots of complex numbers, geometric interpretations; Fundamental theorem of algebra. • Theory of Quadratic equations, quadratic equations in real and complex number system and their solutions. • Arithmetic and geometric progressions, arithmetic, geometric and arithmetico• geometric series, sums of finite arithmetic and geometric progressions, infinite geometric series, sums of squares and cubes of the first n natural numbers. • Logarithms and their properties. • Exponential series. • Permutations and combinations, Permutations as an arrangement and combination as selection, simple applications. • Binomial theorem for a positive integral index, properties of binomial coefficients, Pascal's triangle • Matrices and determinants of order two or three, properties and evaluation of determinants, addition and multiplication of matrices, adjoint and inverse of matrices, Solutions of simultaneous linear equations in two or three variables, elementary row and column operations of matrices, Types of matrices, applications of determinants in finding the area of triangles. • Sets, Relations and Functions, algebra of sets applications, equivalence relations, mappings, one•one, into and onto mappings, composition of mappings, binary operation, inverse of function,



Topics	
	<p>functions of real variables like polynomial, modulus, signum and greatest integer.</p> <ul style="list-style-type: none"> Mathematical reasoning and methods of proofs, Mathematically acceptable statements. Connecting words/phrases – consolidating the understanding of “if and only if (necessary and sufficient) condition”, “implies”, “and/or”, “implied” by”, “and”, “or”, “there exists” and through variety of examples related to real life and Mathematics. Validating the statements involving the connecting words – difference between contradiction, converse and contra positive. Mathematical induction Linear Inequalities, solution of linear inequalities in one variable (Algebraic) and two variables (Graphical)
Trigonometry	<ul style="list-style-type: none"> Measurement of angles in radians and degrees, positive and negative angles, trigonometric ratios, functions with their graphs and identities. Solution of trigonometric equations. Inverse trigonometric functions
Two-dimensional Coordinate Geometry	<ul style="list-style-type: none"> Cartesian coordinates, distance between two points, section formulae, shift of origin. Straight lines and pair of straight lines: Equation of straight lines in various forms, angle between two lines, distance of a point from a line, lines through the point of intersection of two given lines, equation of the bisector of the angle between two lines, concurrent lines. Circles: Equation of circle in standard form, parametric equations of a circle. Conic sections: parabola, ellipse and hyperbola their eccentricity, directrices & foci.
Three dimensional Coordinate Geometry	<ul style="list-style-type: none"> Co-ordinate axes and co-ordinate planes, distance between two points, section formula, direction cosines and direction ratios, equation of a straight line in space and skew lines. Angle between two lines whose direction ratios are given, shortest distance between two lines. Equation of a plane, distance of a point from a plane, condition for coplanarity of three lines, angles between two planes, angle between a line and a plane.
Differential calculus	<ul style="list-style-type: none"> Domain and range of a real valued function, Limits and Continuity of the sum, difference, product and quotient of two functions, Differentiability.



Topics	
	<ul style="list-style-type: none"> • Derivative of different types of functions (polynomial, rational, trigonometric, inverse trigonometric, exponential, logarithmic, implicit functions), derivative of the sum, difference, product and quotient of two functions, chain rule, parametric form. • Geometric interpretation of derivative, Tangents and Normal. • Increasing and decreasing functions, Maxima and minima of a function. • Rolle's Theorem, Mean Value Theorem and Intermediate Value Theorem.
Integral calculus	<ul style="list-style-type: none"> • Integration as the inverse process of differentiation, indefinite integrals of standard functions. • Integration as the inverse process of differentiation, indefinite integrals of standard functions. • Definite integrals and their properties, Fundamental Theorem of Integral Calculus, applications in finding areas under simple curves. • Application of definite integrals to the determination of areas of regions bounded by simple curves.
Ordinary Differential Equations	<ul style="list-style-type: none"> • Order and degree of a differential equation, formulation of a differential equation whose general solution is given, variables separable method. • Solution of homogeneous differential equations of first order and first degree • Linear first order differential equations
Probability	<ul style="list-style-type: none"> • Various terminology in probability, axiomatic and other approaches of probability, addition and multiplication rules of probability. • Conditional probability, total probability and Baye's theorem • Independent events • Discrete random variables and distributions with mean and variance
Vectors	<ul style="list-style-type: none"> • Direction ratio/cosines of vectors, addition of vectors, scalar multiplication, and position vector of a point dividing a line segment in a given ratio. • Dot and cross products of two vectors, projection of a vector on a line. • Scalar triple products and their geometrical interpretations.
Statistics	<ul style="list-style-type: none"> • Measures of dispersion • Analysis of frequency distributions with equal means but different variances



Topics	
Linear Programming	<ul style="list-style-type: none">• Various terminology and formulation of linear Programming• Solution of linear Programming using graphical method, feasible and infeasible regions, feasible and infeasible solutions, optimal feasible solutions (upto three nontrivial constraints)
Mathematical modelling	<ul style="list-style-type: none">• Formulation of simple real life problem, solution using matrices, calculus and linear programming.

✓ BITSAT 2024 English Proficiency Syllabus

his test is designed to assess the test takers' general proficiency in the use of the English language as a means of self-expression in real-life situations and specifically to test the test takers' knowledge of basic grammar, vocabulary, ability to read and comprehend, and also the ability to apply the elements of effective writing. Some topics that candidates need to study to perform well in this section are:

Topics	
Grammar	<ul style="list-style-type: none">• Agreement, Time and Tense, Parallel construction, Relative pronouns• Determiners, Prepositions, Modals, Adjectives• Voice, Transformation• Question tags, Phrasal verbs
Vocabulary	<ul style="list-style-type: none">• Synonyms, Antonyms, Odd Word, One Word, Jumbled letters, Homophones, Spelling• Contextual meaning.• Analogy



Topics	
Reading Comprehension	<ul style="list-style-type: none">• Content/ideas• Vocabulary• Referents• Idioms/Phrases• Reconstruction (rewording)
Composition	<ul style="list-style-type: none">• Rearrangement• Paragraph Unity• Linkers/Connectives

✓ BITSAT 2024 Logical Reasoning Syllabus

This section of BITSAT 2024 is designed to judge the candidate's reasoning abilities in verbal and nonverbal areas. A candidate who is able to think logically, perceive the data accurately, understand the relationships correctly, figure out the missing numbers or words, and apply rules to new and different contexts will be able to score well in this section.



Topics	
Verbal Reasoning	<ul style="list-style-type: none"> • Analogy: Analogy means correspondence. In the questions based on analogy, a particular relationship is given and another similar relationship has to be identified from the alternatives provided • Classification: Classification means to assort the items of a given group on the basis of certain common qualities they possess and then spot the odd option out. • Series Completion: Here series of numbers or letters are given and one is asked to either complete the series or find out the wrong part in the series. • Logical Deduction: Reading Passage: Here a brief passage is given and based on the passage the candidate is required to identify the correct or incorrect logical conclusions. • Chart Logic: Here a chart or a table is given that is partially filled in and asks to complete it in accordance with the information given either in the chart/table or in the question.
Nonverbal Reasoning	<ul style="list-style-type: none"> • Pattern Perception: Here a certain pattern is given and generally a quarter is left blank. The candidate is required to identify the correct quarter from the given four alternatives. • Figure Formation and Analysis: The candidate is required to analyze and form a figure from various given parts. • Paper Cutting: It involves the analysis of a pattern that is formed when a folded piece of paper is cut into a definite design. • Figure Matrix: In this, more than one set of figures is given in the form of a matrix, all of them following the same rule. The candidate is required to follow the rule and identify the missing figure. • Rule Detection: Here a particular rule is given and it is required to select from the given sets of figures, a set of figures, that obeys the rule and forms the correct series.

This section has questions that measure the above-mentioned abilities such tasks as detecting missing links, following directions, classifying words, establishing sequences, and completing analogies.

✓ BITSAT 2024 Biology Syllabus



Topics	
Diversity in Living World	<ul style="list-style-type: none"> • Biology – its meaning and relevance to mankind • What is living; Taxonomic categories and aids; Systematics and Binomial system of nomenclature. • Introductory classification of living organisms (Two-kingdom system, Five-kingdom system) • Plant kingdom – Salient features of major groups (Algae to Angiosperms) • Animal kingdom – Salient features of Nonchordates up to phylum, and Chordates up to class level.
Cell: The Unit of Life; Structure and Function	<ul style="list-style-type: none"> • Cell wall; Cell membrane; Endomembrane system (ER, Golgi apparatus/Dictyosome, Lysosomes, Vacuoles); Mitochondria; Plastids; Ribosomes; Cytoskeleton; Cilia and Flagella; Centrosome and Centriole; Nucleus; Microbodies. • Structural differences between prokaryotic and eukaryotic, and between plant and animal cells. • Cell cycle (various phases); Mitosis; Meiosis. • Biomolecules – Structure and function of Carbohydrates, Proteins, Lipids, and Nucleic acids. • Enzymes – Chemical nature, types, properties and mechanism of action.
Genetics and Evolution	<ul style="list-style-type: none"> • Mendelian inheritance; Chromosome theory of inheritance; Gene interaction; Incomplete dominance; Co-dominance; Complementary genes; Multiple alleles • Linkage and Crossing over; Inheritance patterns of hemophilia and blood groups in humans. • DNA –its organization and replication; Transcription and Translation • Gene expression and regulation; DNA fingerprinting. • Theories and evidences of evolution, including modern Darwinism.
Structure and Function – Plants	<ul style="list-style-type: none"> • Morphology of a flowering plant; Tissues and tissue systems in plants; Anatomy and function of root, stem (including modifications), leaf, inflorescence, flower (including position and arrangement of different whorls, placentation), fruit and seed; Types of fruit; Secondary growth • Absorption and movement of water (including diffusion, osmosis and water relations of cell) and of nutrients; Translocation of food; Transpiration and gaseous exchange; Mechanism of stomatal movement. • Mineral nutrition – Macro- and micro-nutrients in plants including deficiency disorders; Biological nitrogen fixation mechanism.



Topics	
	<ul style="list-style-type: none"> • Photosynthesis – Light reaction, cyclic and non-cyclic photophosphorylation; various pathways of carbon dioxide fixation; Photorespiration; Limiting factors. • Respiration – Anaerobic, Fermentation, Aerobic; Glycolysis, TCA cycle; Electron transport system; Energy relations.
Structure and Function - Animals	<ul style="list-style-type: none"> • Human Physiology – Digestive system – organs, digestion and absorption; Respiratory system – organs, breathing and exchange and transport of gases. • Body fluids and circulation – Blood, lymph, double circulation, regulation of cardiac activity; Hypertension, Coronary artery diseases. • Excretion system – Urine formation, regulation of kidney function. • Locomotion and movement – Skeletal system, joints, muscles, types of movement. • Control and co-ordination – Central and peripheral nervous systems, structure and function of neuron, reflex action and sensory reception; Role of various types of endocrine glands; Mechanism of hormone action.
Reproduction, Growth and Movement in Plants	<ul style="list-style-type: none"> • Asexual methods of reproduction • Sexual Reproduction – Development of male and female gametophytes; Pollination (Types and agents); Fertilization; Development of embryo, endosperm, seed and fruit (including parthenocarpy and elminth). • Growth and Movement – Growth phases; Types of growth regulators and their role in seed dormancy, germination and movement • Apical dominance; Senescence; Abscission; Photo- periodism; Vernalisation • Various types of movements.
Reproduction and Development in Humans	<ul style="list-style-type: none"> • Male and female reproductive systems • Menstrual cycle; Gamete production; Fertilisation; Implantatio • Embryo development • Pregnancy and parturition • Birth control and contraception
Ecology and Environment	<ul style="list-style-type: none"> • Meaning of ecology, environment, habitat and niche. • Ecological levels of organization (organism to biosphere); Characteristics of Species, Population, Biotic Community and



Topics	
	<p>Ecosystem; Succession and Climax. Ecosystem – Biotic and abiotic components; Ecological pyramids; Food chain and Food web</p> <ul style="list-style-type: none"> • Energy flow; Major types of ecosystems including agroecosystem. • Ecological adaptations – Structural and physiological features in plants and animals of aquatic and desert habitats. • Biodiversity and Environmental Issues – Meaning, types and conservation strategies (Biosphere reserves, National parks and Sanctuaries), Air and Water Pollution (sources and major pollutants); Global warming and Climate change; Ozone depletion; Noise pollution; Radioactive pollution; Methods of pollution control (including an idea of bioremediation); Deforestation; Extinction of species (Hot Spots).
Biology and Human Welfare	<ul style="list-style-type: none"> • Animal husbandry – Livestock, Poultry, Fisheries; Major animal diseases and their control. Pathogens of major communicable diseases of humans caused by fungi, bacteria, viruses, protozoans and helminthes, and their control. • Cancer; AIDS. • Adolescence and drug/alcohol abuse • Basic concepts of immunology. • Plant Breeding and Tissue Culture in crop improvement
Biotechnology and its Applications	<ul style="list-style-type: none"> • Microbes as ideal system for biotechnology • Microbial technology in food processing, industrial production (alcohol, acids, enzymes, antibiotics), sewage treatment and energy generation. • Steps in recombinant DNA technology – restriction enzymes, NA insertion by vectors and other methods, regeneration of recombinants • Applications of R-DNA technology in human health –Production of Insulin, Vaccines and Growth hormones, Organ transplant, Gene therapy. • Applications in Industry and Agriculture – Production of expensive enzymes, strain improvement to scale up bioprocesses, GM crops by transfer of genes for nitrogen fixation, herbicide-resistance and pest-resistance including Bt crops.

BITSAT 2024 Exam Pattern



Candidates can check the important details of the BITSAT 2024 exam pattern below. Since the BITSAT 2024 syllabus and exam pattern will go hand-in-hand, the candidates are advised to refer to both while preparing for the examination.

Section	Subject	Number of Questions. of Questions
Part I	Physics	30
Part II	Chemistry	30
Part III	English Proficiency	10
	Logical Reasoning	20
Part IV	Mathematics/Biology (BPharma)	40
Total		130

Previous Year Question Paper [PYQ]-

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