Professional Admissions Test Syllabus 2020 entry

> › There will be negative marking for all multiple choice questions.
> › **Model Test Papers** are available on the university's website - **sssihl.edu.in**

B.ED.

Admission to B.Ed. programme of the Institute will be based on the performance in admission test and interview.

QUESTION PAPER FORMAT:

PART A
General English: 50 Marks / 50 Mins
› Reading Comprehension.
› Correction of Sentences, Articles, Prepositions, Tenses, Spelling.
› Vocabulary, Synonyms, Antonyms.
› Transformation of Sentences - Simple, Compound and Complex. Voices, Direct Speech and Indirect Speech.

Situational Analysis: 25 Marks / 25 Mins
The purpose of this sub test is to assess the candidate's ability to analyze a given situation with all its implications and, her capacity to respond to different problems and values issues raised.

PART B
Subject Test: 100 Marks / 100 Mins
Candidates to take a test in either **one** of the following subjects:

› Mathematics
› Physical Sciences
› Biological Sciences
› Social Studies

Part B: MATHEMATICS

› Sets-relations-binary operations-semi groups-groups-subgroups-normal subgroups-homomorphism-Functions permutations permutation groups-cyclic groups-quotient group- automorphism.
› Rings-Integral domains-fields-characteristic-homomorphism-Ideals-Prime Ideals-maximal ideals-Rings of permutations-polynomials-polynomial rings.
› Vector spaces-linearly independent vectors-Basis-dimension-linear transformation--Null space--Range--Rank of a linear transformation.
› Elementary matrix operations-Elementary matrices–Determinants-properties-rank of matrix-inverse of a matrix- Eigen vectors- Eigen values-systems of linear equations.
› Three dimensional geometry--Coordinates--distance formula-direction cosines-plane- angle between two planes–perpendicular distance from a point-Equation of a line-skewlines–shortest distance-The sphere tangent plane power of a point-polar plane and pole-radical plane-coaxial system of spheres-The circle-radius-centre.
› Real numbers-properties-functions-range-sequences-series-limits-continuity; Differentiability-differentiation-mean value theorems--L'Hospital rules--Integration definite integrals- Reimann integral.
› Differential equations-first order and first degree-different forms–Exact differential equations-change of variables-equation of first order but not of first degree-higher order linear differential equations-system of linear differential equations.
› Elements of Number theory-Divisibility-primes- congruences-solutions of congruences- congruences of degree 1; The Euler function O.-Quadratic equations-quadratic expressions-change of sign–roots maximum-minimum values.

PART B: PHYSICAL SCIENCES

PHYSICS (50 Marks)
› Vector Analysis: Scalar and Vector fields, Gradient of a scalar field. Divergence and curl of a vector field
› Mechanics of particles: Laws of motion, Motion of variable mass system. Conservation of energy and momentum
› Central forces: Central forces - definition and examples, Conservative nature of central forces. Equation of motion under a central force, Gravitational field, motion under inverse square law, derivation of Kepler's laws
› Kinetic theory of gases: Deduction of Max Well's law of distribution of molecular speeds - Transport phenomena - Viscosity, thermal conduction and diffusion of gases.
› Diode theory: Intrinsic and extrinsic semiconductors; pn junction diode; approximations of a diode; biasing and its effects; V-I characteristics, specifications of a diode Rectifiers: Half wave rectifier, full wave rectifier, bridge rectifier, power supply LC and RC filters and regulators; Types of diodes and their applications: power, signal, Zener, Schotkky, LED, 7-segment displays and photodiodes Clippers; negative and positive clampers; voltage multipliers Zener diode as a constant voltage source & as a regulator Use of LED as a display, high frequency application of Schotkky, photodiode
› Polarization and double effraction: Polarized light - Brewsters law -Malus Law - phenomenon of double refraction is calcite - Refraction of plane wave incident on a negative crystal like calcite - Nichol prism. Analysis of polarized light by quarter wave plate - Babinet compensator.
› Newton's Laws, Equations of motion and their Solutions for a Single Particle: Newton's laws of motion and frame of reference, relative velocity; Applications of Newton's laws to the motion of a single particle – Concepts of kinetic energy and potential energy, conservative force and Work-Energy theorem; Equations of Motion and their solutions for motion under - constant force
› Oscillations: Simple harmonic oscillator-simple pendulum, physical pendulum, spring mass system; damped harmonic oscillator; forced oscillations; coupled oscillations
› Waves: Vibrating Strings; equation of motion in a string- solution; Normal modes of vibration
› Electrostatics-I: The electric field: Coulombs law; continuous charge distribution ,Divergence and curl of electrostatic fields: field lines, flux and Gauss law ,Divergence of E; Application of Gauss's law:spherical, cylindrical and plane symmetries; curl of E, Work and energy in Electrostatics: work done to move a charge; energy of a point charge distribution; energy of a continuous charge distribution Conductors: basic properties; induced charges; surface charge and force on a conductor; Capacitors
› Nuclear Physics: Radioactivity: The radioactive decay law; half-life and mean life; Statistical nature of radioactivity; statistical errors in nuclear physics, Radioactive growth and decay; transient and secular equilibrium, Natural

radioactivity and radioactive series Artificial radioactivity; Determination of age of the Earth, Carbon dating; Units for measuring radiation; Nuclear Reactions: Introduction; nomenclature; Types of nuclear reactions ,Balance of mass and energy in nuclear reactions

› Constituents of a nucleus; Discovery of neutron, Nuclear radius; distribution of nuclear charge; Measurement of nuclear radius, Nuclear mass and abundance of nuclides; Mass spectrometer, Nuclear binding energy; Nuclear angular momentum and parity; statistics, Nuclear Magnetic moment; Nuclear electric quadrupole moment; Nuclear excited states; failure of proton-electron hypothesis

› Electromagnetic induction: Faraday's law- Lenz's law-expression for induced emf –electromotive force-time varying magnetic fields - Betatran - Ballistic galvanometer-theory-damping correction-self and mutual inductance, coefficient of coupling, calculation self-inductance of along solenoid-toroid-energy stored in magnet in field principles of transformer.

› Varying and alternating currents: CR circuits, LR circuits, growth and decay of currents, LCR circuit, critical damping-alternating current, relation between current and voltage in pure RC and L-vector diagrams LCR circuit power factor, series and parallel resonant circuit-Q-factor.

› Maxwell's equations and electromagnetic wave: A review of basic laws of electricity and magnetism- displacement current -Maxwell's equations in differential form Maxwell's wave equation. Plane electromagnetic waves transverse nature of electromagnetic waves Poynting theorem, production of electromagnetic waves (Hertz experiment)

CHEMISTRY (50 Marks)
› Atomic Structure and Elementary Quantum Mechanics
› Black Body radiation, Plack's Radiation law, Photoelectric effect, heat capacity of solids, Comption effect. De Broglie's hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schordinger's wave equation and its importance, physical interpretation of the wave function.
› Chemical Bonding: Lonic solids - lattice and salvation energy, solubility of ionic solids rule, power and polarisability of ions, covalent nature of ionic bond

covalent bond –Stereochemistry of inorganic molecules - common hybridization and shapes of molecules Molecular orbital theory - Shapes and sign convention of atomic orbital, modes of overlapping, concepts of sigma and pi bonds, criteria for forming molecular orbital from atomic orbital, LCAO - concept, types of molecular orbital - bonding, antibonding and non-bobding, electron density distribution diagram for H_2^+, MOED of homonuclear - H_2, He_2^+, B_2, C_2, N_2, O_2, F_2 and their ions (unhybridised diagrams only) and heteronuclear diatomic molecules CO, CN^-, NO,NO^- and HF. Bond order and magnetic properties.

› Periodic properties
› Review of trends in atomic and ionic radii - covalent radii - single, double and triple bond covalent radii, van der Waal radii, radii of cations, anions isoelectronic ions, ionization energy, Electropositivity, basic nature, reducing behavior, electron affinity and electro negativity - Methods of determination and evaluation - Pauling's and Mulliken's approach, application in predicting and explaining chemical behavior - nature of bond, bond length and bond angles, diagonal relationship.

› Chemistry of elements of Second and Third Transition series- comparative treatment with their 3d analogues with respect to oxidation state, magnetic behavior, spectral properties.Study of Ti, Cr and Cu triads-Titanium triad - electronic configuration, reactivity of +III and +IV states -oxides, halides. Chromium triad - reactivity of +III and +VI states. Copper triad - reactivity of +I, +II, and +III states.

› Metals: Theories of bonding in metals - Free electron theory - thermal and electrical; conductivity of metals, drawbacks. Valence bond theory - explanation of metallic properties and its limitations. Band theory - explanation of metallic properties, conductors, semiconductors and insulators. General methods involved in extraction of metals - minerals and ores, ore concentration –electromagnetic separation, gravity separation - wilfley table, hydraulic classifier, leaching, froth flotation, Calcination and roasting. Acid and alkali digestion. Reduction of oxides, carbonates, halides, sulphides, sulphates - smelting, flux, auro reduction, alumino - thermic reduction, hydrometallurgy, electrolytic reduction.

› Gaseous state: Deviation of real gases from ideal behavior, Vanderwaal's equation of state. Critical Prenomena: PV - isotherms of real gases, continuity of state, Andhrew's isolthems of carbon dioxide. The vander waals equation and the critical state, Derivation of relationship between critical constants and Vander waal's constants. Experimental determination critical constants.

› Liquid state: Intermolecular forces, structure of liquids (qualitative description). Structural different between solids, liquids and gases. Liquid crystals, the mesomorphic state: classification of liquid crystals into Semectic and Nematic, differences between liquid crystal and solid/liquid. Application of liquid crystals as LCD devices,lubricants and in digestion/assimilation of food.

› Solutions: Liquid - liquid mixtures - ideal liquid mixtures, Raoult's and Henry's law. Fractional distillation. Partially miscible liquids - phenol-water, trimethyl amine-water, nicotine-water systems, Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids and steam distillation.

› Chemical Kinetics: Rate of a reaction, factors influencing the rate of a reaction - concentration, temperature, pressure, solvent, light and catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions - Zero order, first order, second order, pseudo first order, half-life and mean life. Determination of order of a reaction - differential method, method of integration, half-life method and isolation method. Radioactive decay as first order phenomenon. Arrhenius equation, and concept of activation energy. Theories of chemical kinetics: effect of temperature on rate of a reaction Simple collision theory based on hard sphere model.

› Thermodynamics: Definition of thermodynamic terms: System, surroundings, types of systems, and intensive and extensive properties. State and path functions and their differentials.

› Thermodynamic process. Concept of heat and work.

› First law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law - Joule. Thomson coefficient and inversion temperature.

› Thermodynamic scale of temperature. Concept of entropy, entropy as a state function, entropy as a function of V & T,

entropy as a function of P & T, entropy change in physical processes. Gibbs and Helmholtz functions: Gibbs function (G)

› Acids and Bases: Arrhenius, Lowry-Bronsted concepts of acids and bases-Strengths of acids and bases-Dissociation of poly-protic acids, Lewis theory of acids and bases: HSAB(Hard and soft acid and base) Concept-Pearson's classification as hard and soft acids and bases, acid-base strength and hardness and softness.

› Carbohydrates: Introduction: Classification and nomenclature-classification into mono, oligo and polysacchrides into pentoses, hexoses etc. into aldoeses and ketoses. Monosaccharides: All discussion to be confined to (+) glucose as an example of aldo hexoses and (-) fructose as example of ketohexoses. Chemical properties and structural elucidation: Number of optically active, isomers possible for the structure, configuration of glucose based on D-glyceraldehydes as primary standard (No proof for configuration is required). Evidence for cyclic structure of glucose (some negative aldehyde tests and mutarotation).

› Amino acids and proteins: Introduction: Definition of Amino Acids, classification of Amino acids into alpha, beta and gama amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples Zwitter ion structure-salt like character, solubility, melting points, amphoteric character, definition of isoelectric point. Chemical properties: General reactions - Reactions due to amino and carboxyl groups- Lactams from gamma and delta amino acids by heating peptide bond (amide linkage). Structure and nomenclature of peptides and proteins, peptide synthesis.

Part B: BIOLOGICAL SCIENCES

BOTANY (50 Marks)

› Evolution of Life and Diversity of Microbes. Origin and evolution of Life -an outline.
Viruses: Structure, replication and transmission; plant diseases caused by viruses and their control.
Bacteria: Structure, nutrition, reproduction and economic importance, an outline of Plant diseases of important crop plants caused by bacteria and their control. Brief account of Archaebacteria, Chlamydia, Actinomycetes and Mycoplasma, cyanobacteria

› Algae and Fungi: General account, thallus organisation, structure, reproduction, classification and economic importance - Oedogonium, Ectocarpus and Polysiphonia.
Fungi: Structure, reproduction and life history of Cercospora, Penicillium, Puccinia, Alternaria, General account of plant diseases caused by Fungi and their control.
Lichens: Structure and reproduction; ecological and economic importance.

› Bryophytaand Pteridophyta
Bryophytes: General characters, classification and alternation of generations. Structure, reproduction, life history and systematic position of Marchantia, Anthoceros and Funaria, Polytrichum.Evolution of Sporophyte in Bryophytes. Pteridophytes: General characters, classification, alternation of generations and evolution of sporophtyte. Structure, reproduction, life history and systematic position of Rhynia, Lycopodium, Equisetum Evolution of stele, heterospory and seed habit in Pteridophytes.

› Gymnosperms and paleobatany
General characters, structure, reproduction and classification. Morphology of vegetative and reproductive parts, systemic position, life history of Pinus and Gnetum. Distribution and economic importance; endangered Gymnosperms.
Palaeobotany: Introduction, Fossils and fossilization; Geological time scale; Importance of fossils.
Bennettitales: General account

› Anatomy:
Meristems, Leaf, Stem and root. Anamalous secondary growth-General account. Stem-Boerhavia, Bignonia, Dracaena; Wood structure: General account. Study of local timbers–Teak, Rosewood, Red sanders, Nallamaddi Yegisa, and Neem

› Embryology:
History and importance of Embryology, Anther structure, Microsporogenesis and development of male gametophyte. Ovule structure and types; Megasporogenesis; types and development of female gametophyte. Pollination-Types; Pollen-pistil interaction. Fertilization. Endosperm-Development and types. Embryo-development and types; Polyembryony and Apomixis- an outline.
Palynology: Principles and applications.

Taxonomy:
Plant systematics, Systematics vs Taxonomy, Types of classification: Artificial, Natural and Phylogenetic. Systems of classification: Bentham &Hooker, Engler & Prantle. Current concepts in Angiosperm Taxonomy: Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy. Nomenclature and Taxonomic resources, Herbarium

› Medicinal Botany:
Ethnomedicine, Outlines of Ayurveda, Sidda, Unani and Homeopathic systems of traditional medicine. Plants in primary health care, Traditional medicine vs Modern medicine. Pharmacognosy, Plant crude drugs

› Cell Biology:
Plant cell envelops, Nucleus, Chromosome and its types, Karyotype. Cell division: Cell cycle and its regulation;

› Genetics:
Mendelism, Genetic interactions, Linkage and crossing over.
Mutations: Chromosomal aberrations, Gene Expressions, Extra nuclear genome: Mitochondrial and plastid DNA, plasmids.

› Ecology:
Concept and components of Ecosystem. Energy flow, food chains, food webs, ecological pyramids,
Plants and environment: Ecological factors-Climatic (light and temperature), edaphic.
Ecological adaptations of plants, Population ecology, Community ecology, Production ecology

› Biodiversity and Conservation:
Biodiversity: Concepts, Convention on Biodiversity - Earth Summit. Types of biodiversity.
Levels, threats and value of Biodiversity. Hot spots of India, Agro-biodiversity, Principles of conservation, Role of organisations in the conservation of Biodiversity.

› Plant Physiology:
Water Relations, Mineral Nutrition, Enzymes, Photosynthesis, Translocation of organic substances
Physiology: Respiration, Nitrogen Metabolism, Lipid Metabolism,growth and Development,Stress Physiology

› Tissue Culture and Biotechnology:
Tissue culture, Callus culture, cell and protoplast culture, Somatic hybrids and cybrids. Applications of tissue culture.
Biotechnology: Introduction, history and scope. rDNA technology: Vectors and gene cloning and transgenic plants.

› Seed Technology and Horticulture:

Seed: Seed dormancy; causes and methods of breaking dormancy, Seed storage, Seed production technology, seed testing and certification, Horticulture techniques, Floriculture, Micro irrigation systems, Vegetative Propagation of plants, Layering and bud grafting, Role of plant growth regulators in horticulture.

ZOOLOGY (50 Marks)

› Biology of Invertebrates and cell biology: General characters and classification of Major Invertebrate phyla with examples up to orders,
Ultra structure of Animal Cell: Cell Division, Mitosis and Meiosis. Structure and function of the following cell organelles: (i) Plasma Membrane: Membrane, Transport of small molecules, Cell Junctions, Cell adhesion, (ii) Cytoskeleton,(iii) Golgi Complex, (iv) Lysosomes, (v) Role of mitochondria in cellular energy, transactions, (vi) Chromosomes-Structure and type, Salivary gland chromosomes.

› Animal Physiology, Behaviour and Ecology:
Nutrition: Types, vitamins and minerals. Digestion, Respiration, Circulation, Excretion, Nervous transmission, Muscle contraction in mammals. Endocrine glands, Hormonal control of reproduction in mammals. Concept of Homeostasis. Animal Behaviour, Animal Ecology, Animal associations, Environments and adaptive features of animals Environmental pollution, Wild life, wild life sanctuaries and national parks of India.

› Biology of Chordates, Genetics, Evolution and Zoogeography:
Protochordata, Cyclostomata, Parental care in Amphibia, Dentition in Mammals, Developmental Biology
Genetics: Gene interaction with 3 examples, Sex determination, Sex linked inheritance, Blood group inheritance, Fine structure of gene, Operon/ concept, Cloning, Lethal genes, Chromosomal Aberration and human diseases. Evolution and Zoogeography, Modern synthetic theory of Evolution, Mutations, Genetic basis of Evolution, Genetic Drift (Hardy Weinberg's Law), Isolation and speciation, Characteristics of the following Zoogeographic regions and their fauna

Part B: SOCIAL STUDIES

POLITICAL SCIENCE
POLITICAL SCIENCE CONCEPTS, THEORIES AND INSTITUTIONS
› Introduction, definition of Political Science
› State–nation and Civil Society
› Sovereignty: Monism and Pluralism
› Theories of Origin of the State: Social Contract and Evolutionary (Historical)
› Concepts: Law, Liberty and Equality–Their Relationship theories and kinds of Rights
› Forms of Government
› Theory of Separation of Powers
› Organs of Government

GOVERNMENT AND POLITICS
› Salient Features of Indian Constitution
› Evolution of Indian Constitution– nationalist Movement and Philosophical Foundations
› Indian Federation–Centre-State relations
› President–election, Powers and Functions–Prime Minister and Council of Ministers
› Parliament–Composition, Powers and Functions
› Judiciary–Supreme Court, Composition, Powers, Functions and Judicial review– Judicial Activism.
› Party System: national and regional parties, Coalitional Politics.
› Election Commission–Electoral reforms and voting behavior
› State Government–
› Governor, Chief Minister and Council of Ministers–powers and Functions

POLITICAL THOUGHT
› Ancient Indian Political Thought: Sources of Ancient Indian Political Thought, Manu: Varnadharma and Dandaneeti, Kautilya: State and Society, Gouthama Buddha: Dhamma and Sangha
› Modern Indian Political Thought: Gandhi: Ahimsa and Satyagraha, Nehru : democratic Socialism, Ambedkar: Annihilation of Caste, M.N.Roy: Radical Humanism
› Western Political Thought: Plato, Aristotle, Machiavelli, Thomas Hobbes, John Locke, J.J.Rousseau, Jermy
› Benthom, J.S.Mill, Hegel, Marx

ECONOMICS
› Micro- Macro, Static-Dynamic, Normative and Positive Economics.
› Cardinal and Ordinal approaches, and law of diminishing marginal utility.
› Law of variable proportions, and returns

to scale.
› Different concepts of costs and their Inter-reaction.
› Concepts of National Income.
› Meaning of Economic Development and Measure of Economic Development-GNP, PQLI, and HDL
› Sources of Public revenue.
› Canons and Effects of Public Expenditure.
› Functions and classification of Money.
› Budgets and Money supply-concept of Inflation.
› Functions of commercial banks and functions of Reserve Bank of India.
› Methods of Credit control.
› Importance of Agriculture in the Indian Economy,
› Population growth in India-causes- problems of over population.
› Regional disparities- causes of inequalities in Income and Wealth.
› Meaning of a mixed Economy, characteristic features.
› The concept of poverty-causes of poverty in India.
› Types of unemployment-Disguised, Seasonal, Frictional, And Structural.
› Objectives of Planning in India-Important achievements and failures of planning India.

GEOGRAPHY
› Unit-I: Principles of Physical Geography:
› Unit-II: Submarine relief - Distribution of temperature and salinity - Movements of Ocean water: Waves, Tides and Currents - Currents of the Pacific, the Atlantic and the Indian Ocean - Ocean deposits.
› Unit-III: Regional Geography of India: Locational aspects, Major Physiographic regions, climate, drainage, soil types and natural vegetation-pattern and growth trends of population, urbanization -Agriculture: Rice, Wheat, Cotton, Jute, Sugarcane, Tea and Coffee - irrigation and power development in India-Minerals: Iron, coal and petroleum-Composition and pattern of trade.
› Unit-IV: Regional Geography of Asia: Scope and content of Regional Geography-location, Relief, Drainage, Climate, Natural Vegetation, Agriculture. Types mineral wealth (iron, tin, coal and oil); Industrial development, industries (shipbuilding, petrochemicals, automobiles); Population distribution; Broad outlines of the following as regions: South East Asia: Thailand, Malaysia, Indonesia - South West Asia: Iran, Iraq, Afghanistan.

HISTORY

› Unit–I: Indus valley civilization – Vedic culture -–Rise of new religious Movements–Jainism and Buddhism in 6 th Century B.C Impact on society and culture.

› Unit–II: A brief survey of political conditions in ancient India –Magadha - Alexander's Invasion and mouryas – Ashoka's Dharma. Its nature and propogation–Mouran Administration – Economy – Art and Architecture.

› Unit–III: Post -Mouryan period in North India– A brief political survey of Kushans, Guptas, Puswabuthi and Rajputs Polity and Administration – Social condition – Caste system – position of Women – Economy – Indian Feudalism –Art – Architecture – Education, Literature, Philosophy, Science and Technology.

› Unit -IV: A brief political survey of South India – Sangham Age – Satavahanas – Pallavas - Cholas – Calukyas and Rastrakutas - Kakatiya and Vijayanagara – Polity and Administration, Society Economy – Art and – Architecture.

› Unit –V: Social reform and Literary Movements

› Unit –VI: Invasions of Arabs, Ghaznavids and Ghoris and Delhi Sultanate

› Unit –VII: Impact of Islam on Indian Society and Culture - Bhakthi and Sufi Movements Emergence of Composite culture.

› Unit –VIII: Survey of Sources- Establishment of Mughal Empire– Sur Interrugnam

› Unit- IX: Advent of European powers – Portuguese, Dutch, English and French Expansion and consolidation of British Empire

› Unit –X: Anti - Colonial Upsurge – Peasant and Tribal revolts – 1857 revolt – Causes – results and nature.

› Unit –XI: Factors for social change

› Unit –XII: Indian National Movement –

› Unit –XIII: Emergence of Communal trends – partition of India – Integration of Princely States into Indian Union.

› Unit –XIV: Characteristic features of Renaissance

› Unit –XV: Emergence of nation States in Europe – Nature of Feudalism in Europe and Asia Unit- Age of revolutions – Glorious revolution (1688) – American Revolution (1776) – French Revolution (1789)

› Unit –XVI: World between 1914–1945- Rivalry among colonial powers Imperialist. Hegemony

M.B.A.

QUESTION PAPER FORMAT:
There will be three written tests of three hours total duration. They would be of a pattern similar to CAT, GMAT and MAT. The details of various tests are as follows:

English:
60 Questions (1 Hour)

› This test is designed to test the candidate's command over English and Grammar, his vocabulary, and his ability to use words and phrases effectively. This test is also designed to test the ability of the candidate to read and rapidly digest literature, his ability to extract qualitative and quantitative information, and his ability to communicate precisely.

Quantitative Analysis & Logical Reasoning:
30 Questions (45 mins)

› This test is intended to assess the candidate's ability to handle quantitative information with speed and accuracy. This test is also designed to determine the candidate's ability to draw valid inferences from available information, using logical reasoning and simple mathematical formulae.

Management Aptitude:
30 Questions (30 mins)

› The purpose of this test is to assess the candidate's aptitude for Management profession and his ability to comprehend facts, and analyze given situation. The purpose of this test is also to assess the awareness of the candidate pertaining to national and international issues.

Written English:
(15 mins)

› A short essay on a specific theme

REFERENCE BOOKS
Standard books used for CAT/MAT/GMAT Entrance Examinations.

M.TECH. IN COMPUTER SCIENCE

QUESTION PAPER FORMAT
For the written test, the question paper is divided into two parts:

Written Test: 120 Marks- 2 hours- Computer Science (67%) and Mathematics (33%)- two parts:

Part A: 80 Objective type items - 80 Marks (80 min.). This consists of 60 multiple choice questions of Computer Science- 20 multiple choice questions of Mathematics

Part B: Short Answer type Questions - 40 Marks (40 min.). This consists of 8 x 5 =40 marks- 4 short answer type questions of Computer Science- 4 short answer type questions of Mathematics.
In addition, there is a **General English Aptitude Tes**t: 20 marks- ½ hour- essay type questions- to test English language and communication skills

Practical Programming Skills Test (subject to qualification in written test)- 80 Marks- 2 ½ hours-to test the proficiency in designing, coding and debugging abilities in C language- the coding language will be in Linux platform

Technical Viva voce (subject to qualification in first two components): 30 Marks- to test the comprehension of basics and analytical abilities

Final Interview: An Interview will be conducted for candidates who qualify in the Practical and Viva- voce for final selection.

TOPICS

COMPUTER SCIENCE
The subjects to be covered under this area are: Data Structures & Algorithms, Computer Organization and Architecture, Data Communication and Networks, Database Systems, Operating system and System programming, and C, C++, & Java programming concepts.

Data Structures and Algorithms:
› Asymptotic Relations, Sorting Algorithms, Searching Algorithms, Basic Data Structures like Linked List, Doubly Linked List, Circular Linked List and Binary Tree. Abstract Data Types like Stacks, Queues and Graphs.

Computer Organization and Architecture:
› Computer Arithmetic, Instruction Set Architecture Characteristics, Instruction Cycle, CISC, RISC, Super Scalars Architectures, Instruction Formats, Addressing Modes, Pipelining and Instruction Level Parallelism, Speed-up of a Processor, Control Hazards, Basics of Cache, Cache Coherence, Basics of I/O, Interrupts.

Data Communication and Networks:

› Packet/circuit switching, loss, delay, throughput in a network, protocol layers, OSI & TCP/IP, HTTP,FTP, Electronic mail, DNS, Client server vs P2P architecture, Transport-layer Multiplexing and demultiplexing, sliding window protocols, TCP & UDP protocols, Principles of reliable data transfer, congestion control, Virtual circuit and datagram networks, IPv4, IPv6, Routing algorithms, Multiple access protocols, Error correction-detection, Wireless and Mobile Networks, GSM,CDMA, 802.11 standard, handling mobility in cellular networks, basics of physical layer

Data Base Systems:

› Database languages, View of Data, Relational Model, SQL: set operations, Aggregate functions, Nested Sub queries, Joined relations; ER Model: Constraints, Weak Entity sets, Generalization, Specialization, Reduction to Relational Schemas; Normalization: Different Normal Forms, Functional Dependency, Multi-valued Dependency; Transaction: Transaction concept, ACID properties, Serializability, Recoverability, Testing for serializability.

Operating Systems and System Programming:

› The concept of a process, operations on processes, process states, concurrent processes, process control block, process context, Job and processor scheduling, scheduling algorithms, Problems of concurrent processes, critical sections, mutual exclusion, synchronization, deadlock, Memory organization and management, storage allocation. Virtual memory concepts, paging and segmentation, File organization: blocking and buffering, file descriptor, directory structure, Basics of assemblers, Macro preprocessors and compilers.

Object Oriented Programming Concepts:

› Principles of Object Oriented Programming, Classes, objects, constructors and destructors, Operator overloading, Type conversions, Type of constructors, Function over loading, Inheritance, Polymorphism, File stream – File operators.

Calculus of One and Several Variables:

› Limit, continuity, differentiation and integration of functions of one and more variables. Directional derivative and gradient of a function.

MATHEMATICS

The subjects to be covered are: ODE, Discrete Mathematics, Linear Algebra, Probability and Statistics and Basic Calculus

Linear Algebra:

› Vector spaces, subspaces, basis, linear transformation, matrix of linear transformations, system of linear equations and their solutions using Gaussian elimination method, Eigen values and Eigen vectors, diagonalization of a linear transformation.

Discrete Mathematics:

› Set theory, Mathematical logic, Relations and functions, Trees and Graphs.

Probability and Statistics:

› Random variables, discrete and continuous distributions including Bernoulli, binomial, uniform, Poisson, exponential, hyper-geometric distributions, expectation, moments, central limit theorem, law of large numbers, random sample, sample mean, sample variance, mean, median and mode.

REFERENCE BOOKS

COMPUTER SCIENCE

› Data structures and algorithms in C by Mark Allen Weiss
› Computer Organization and design by David A. Patterson and John L. Hennessy , Elsevier Pub.
› Computer Networking: A Top-Down Approach, 4/E James F. Kurose, Keith W. Ross, Pearson Pub.
› Data Base System Concepts by Silberchatz, Korth and Studarshan, Tata McGraw Hill Pub.
› Systems programming by Lelend Beck, 3rd edition, Pearson India.
› C++ How to Program, 4/e by Paul Deitel

MATHEMATICS

› Calculus by Stanley I. Gossman, Academic Press Pub.
› Linear algebra by Larry smith, 3rd edition, Springer Verlag.

› Discrete Mathematical Structures by Kolman, Busby and Ross, 4th Ed., Pearson Pub.
› Advanced Engineering Mathematics by Kreyszig, 8th ed., Wiley Eastern, 1999.
› Differential Equations by Shapley L. Ross John Wiley and Sons Pub.

M.TECH. IN OPTOELECTRONICS & COMMUNICATIONS

General English Aptitude Test- 20 marks- ½ hour - essay type question- to test English language written communication skills

Written Test- 100 Marks- 3 hours- short answer , multiple choice and problem solving type questions

Technical Viva voce

Final Interview

COMMON FOR B.E. / B.TECH. / M.SC. IN PHYSICS

General English Aptitude Test:
This will consist of an essay type question to test English language written communication skills. The test will be for half an hour with allocation of 20 marks. Linear Algebra: Determinates, System of linear equations, Eigenvalues and eigenvectors, Diagonalization of matrices. Calculus: Limit, continuity and differentiability: 'Hospital rule, Maxima and minima, Taylor's series, Evaluation integrals, Lagrange multipliers, Power series, Fourier series.

Complex variable:

› Analytic functions, Taylor's and Laurent' series, Residue theorem, Cauchy's theorem.
› Vector Calculus: Gradient, Divergence and Curl, Line, surface and volume integrals, Stokes, Gauss and Green's theorems.

Ordinary and Partial Differential Equations:

› ODEs with constant coefficients, variation of parameters, Initial and boundary value problems (BVPs), Power Series solutions, Legendre, Hermite and Bessel's functions, Variables separable method, Solutions heat, wave and Laplace equations.

Programming & Numerical Methods:

› Data Types & Declarations, Program Organization, Arithmetic Statements, Flow of Control-Iterative Statement,

Conditional statement, Unconditional branching, arrays, functions and procedures, pointers, classes, file handling.
› Errors, Interpolation, curve fitting, root finding, solutions of algebraic system, Eigen values – Power method, Numerical integration, Numerical Differentiation, Solution of ODEs and BVPs – RK Methods, Shooting & Crank-Nicholson methods.

FOR B. E. / B. TECH APPLICANTS ONLY
Networks:
› Network graphs: matrices of graphs; Solution methods, Nodal and mesh analysis, Network theorems, Thevenin's and Norton's, Wye-Delta transformation. Steady state analysis, Time and Frequency domain analysis, Solution using Laplace transform, 2port network parameters: transfer functions and state equations.

Electronic Devices:
› Energy bands, Carrier transport, diffusion, drift, mobility, resistivity, Diodes: p-n junction, Zener, BJTs, FETs, JFETs, MOSFETs, PIN and Avalanche; LEDs, LASERs,

Analog Circuits:
› Equivalent circuits of diodes, BJTs, JFETs, and MOSFETs. Simple diode circuits, Single-and multi-stage, differential, operational, feedback and power amplifiers, Frequency response of amplifiers; Op-amp circuits, Filters, Oscillators.

Digital circuits:
› Boolean algebra, logic gates, Digital IC families (DTL, TTL, ECL, MOS, CMOS), Combinational circuits, arithmetic circuits, code converters, multiplexers and decoders. Latches and flip-flops, counters and shift-registers. Sample and hold circuits, ADCs, DACs, Memories, Microprocessor (8085): architecture, programming, memory and I/O interfacing.

Signals and Systems:
› Laplace transform, continuous-time and discrete-time Fourier series and transforms, Z-transform. Sampling theorems. L TI Systems: analysis and signal transmission, Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density.

Control Systems:
› Feedback; transfer function; steady-state errors; Stability criteria; Bode plots; Elementary state variable formulation; Transition matrix and response for L TI systems. On-off, cascade, P, PI, PID and feed-forward controls. Controller tuning and general frequency response.

Communications:
› Analog systems: modulation and demodulation systems, spectral analysis, superheterodyne receivers; hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) AM, FM. Digital systems: PCM, DPCM, DM; ASK, PSK, FSK; matched filter receivers, bandwidth consideration and probability of error calculations for these schemes.

Electromagnetics:
› Maxwell's equations, Wave equation, Pointing vector. Plane waves: propagation, reflection and refraction; phase and group velocity; skin depth; Transmission lines: characteristic impedance; impedance transformation; Smith chart; Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Antennas: Dipole antennas; antenna arrays; radiation pattern; reciprocity theorem, antenna gain.

FOR M.SC. IN PHYSICS APPLICANTS ONLY

Classical Mechanics:
› Lagrange's and Hamilton's formalisms; Equation of motion, Poisson bracket; small oscillations, normal modes; wave equation; Special theory of relativity – Lorentz transformations, relativistic kinematics, mass-energy equivalence.

Electromagnetic Theory:
› Laplace and Poisson equations; conductors and dielectrics; boundary value problems; Ampere's and Biot-Savart's laws; Faraday's law; Maxwell's equations; boundary conditions; electromagnetic waves; radiation from moving charges.

Quantum Mechanics:
› Schrodinger equation; Bound state problems, hydrogen atom; angular momentum and spin; addition of angular momentum; matrix formulation, time independent perturbation theory; elementary scattering theory.

Atomic and Molecular Physics:
› Spectra of one-and many-electron atoms; LS and jj coupling; Zeeman and Stark effects; X-ray spectra; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR;

Thermodynamics and Statistical Physics:
› Laws of thermodynamics; calculation of thermodynamic quantities; microstates, macrostates, phase space; partition function, free energy, classical and quantum statistics; Fermi gas; Black body radiation; Bose-Einstein condensation; first and second order phase transitions, critical point.

Solid State Physics:
› Elements of X-crystallography; structure determination; bonding, elastic properties, defects, lattice vibrations and thermal properties, free electron theory; band theory of solids; metals, semiconductors and insulators; transport properties; optical, dielectric and magnetic properties of solids; elements of superconductivity.

Nuclear and Particle Physics:
› Rutherford scattering; basic properties of nuclei; radioactive decay; nuclear forces; two nucleon problem; nuclear reactions; conservation laws; fission and fusion; nuclear models; particle accelerators, detectors; elementary particles; photons, baryons, mesons and leptons; Quark model.

Electronics:
› Network analysis; semiconductor devices; bipolar transistors; FETs; power supplies, amplifier, oscillators; operational amplifiers; elements of digital electronics; logic circuits.