Admissions Test Syllabus for the following Programmes:

POSTGRADUATE

- Master of Arts in English Language & Literature
- Master of Arts in Economics
- Master of Science in Nanoscience & Nanotechnology
- Master of Science in Food Science & Nutrition
- Master of Science in Food Technology

PROFESSIONAL

- MBA / MBA (Finance)
- M.Tech (Computer Science)
- M.Tech (Optoelectronics and Communications)
- M.Tech (Analytical Methods and Chemical Instrumentation)
- M.Tech (Nuclear Medicine)
- Bachelor of Education
- Master of Education

Candidates can refer to the various syllabi, depending on the course they have applied for, as indicated in their application forms.

POSTGRADUATE PROGRAMMES

General English – Compulsory for all M.A./ M.Sc. Programmes


M.A. (English Language and Literature)


Prescribed texts:

M.A. (Economics)

The test is designed to ensure that selected candidates are able to cope with the requirements of the M.A. (Economics) programme at the University. The way this programme is designed, students should be able to handle issues within an analytical frame, argue logically and articulate their views clearly. They are also expected to undertake processing of data to derive meaningful conclusions and to make empirical judgments consistent with social realities and ethical values.
The question paper of two hours duration and carrying 100 marks, is divided into three sections. Section A consists of objective type questions. Section B has short answer questions, and, Section C has one essay type question. Level and coverage of questions is comparable to those of a good undergraduate programme in economics. Topics covered are as follows:

1. **Economic Theory:**
Consumer behaviour: preference ordering, utility, budget sets and demand functions; Theory of the firm; Costs, supply and factor demand; Market structure: pricing and production under perfect and imperfect competition, General equilibrium and welfare; Taxation; Elements of national income accounting; Level of economic activity under classical assumptions; Keynesian theory of effective demand and employment; Monetary and fiscal policies; International trade.

2. **Quantitative Methods:**
Functions of one variable; Linear and quadratic equations; Derivatives and rules of differentiation; Measures of central tendency and dispersion; Correlation and regression with two variables; Index numbers; Elements of probability theory; Random variables and common distributions.

3. **Indian Economy and Development:**
Basic issues and indicators of economic development; Economic growth; Aspects of development policy: Population growth and employment; Strategies and theories of development; Human values and economic development; Structure of the Indian economy; Human resource development; Persistence of poverty and inequality; New economic policy regime; Indian ethos and policies for all round development; Aspects of the International Economy.

**M.Sc. (Nano Science & Nano Technology)**

As the M.Sc.(NanoScience and NanoTechnology) is an inter disciplinary course, the aspiring students are tested for the knowledge and familiarity in all the four basic science courses. The following is the question paper model and syllabus for the admission test.

The question paper is of two hours duration and carries 100 marks. It is divided into two parts viz., Part-A and Part-B of 50 marks each. Part-A will be common for all the students of different disciplines (for Bioscience, Chemistry, Physics and Mathematics students). Part-B will have three parts viz., 1st section will be for B.Sc.(Bioscience) students, IInd second will be for B.Sc.(Chemistry) students and IIIrd section will be for B.Sc.(Physics & Mathematics) students.

Part-A will consist of questions from all disciplines (Bioscience, Chemistry, Physics and Mathematics) at 10th/12th class CBSE syllabus level.

Part-B will consist of questions from the B.Sc. syllabus of individual disciplines.

**M.Sc. (Food Science and Nutrition) / M.Sc. (Food Technology)**

**For Bachelor of Home Science students:**

**Food Science, Nutrition and Dietetics:** Food as a source of nutrients, composition, properties, characteristics, and nutritive value of different foods (cereal grains, millets, pulses, nuts and oil seeds, fruits and vegetables, milk and milk products, meat, egg, poultry, fish, spices and condiments. Chemistry and biochemical roles of fat soluble vitamins, water soluble vitamins, inorganic elements. 1. Energy requirement: Basal metabolism, total energy requirements. 2. Study of Nutrients: (a) Carbohydrates, proteins, fats - chemistry, biochemistry and nutritional aspects such as digestion, absorption, metabolism, functions, sources and requirements. (b) Vitamins and minerals - functions, sources, requirements, and deficiencies. 3. Water balance. 4. Methods of assessing the nutritional status. 5. Principles involved in adoption of normal diet for formulating therapeutic diet - use of food exchange groups. 6. Diets during pregnancy, lactation, infancy, school age, adolescent, adulthood and old age. 7. Nutritional deficiency diseases. 8. Diet in diseases (metabolic disorders, febrile conditions, surgical & other stress conditions) - causes, symptoms, physiological changes and dietary management. 9. National and International agencies and programmes in the betterment of Nutritional status.

**Human Development:** 1. Principles of child development. 2. Prenatal development and care - postnatal care - neonate – 1st four weeks of life. 3. Infancy - 1 to 2 years: physical, motor, emotional and social development during infancy; 4. Pre-school years (2 to 6 years); Physical growth and sequence, of motor skills, social behaviour, importance of children’s motor activities, intellectual development, oral development; 5. Significance of preschool education; 6. Preschool education: Essentials, Programmes, values of play - parent education; 7. Child from 6
through 12 years: Aspects given under 4th topic; 8. Adolescence: Physical changes, needs, interests, problems and adjustments, social and personality development; 9. Adulthood: Vocational, Marital and Social adjustments; 10. Old Age: Areas of adjustments; Inter-generational conflict.

**Home Management:** 1. Principles of Home Management of resources; 2. Interior decoration and furnishing: Art elements, principles of design, colour, functions and types of lighting, selection, use and care of household equipments.


**For B.Sc. (Biosciences) students:**


**Plant Anatomy:** Types of meristematic and other tissue systems in Plants Anatomy of root, stem and leaf in Dicots and monocots. Micro and Macro Sporogenesis, Endosperm, Polyembryony and embryogenesis in Dicots and Morocots. Plant Physiology: Osmosis, Active Transport, Physiology of Photosynthesis Respiration, Transpiration and translocation, flowering, growth dormancy and Mineral nutrition in plants.


**III. Cell Biology, Genetics & Evolution:** Structure of cell, Cell organelles, Types of Chromosomes Mitosis and Meiosis, Gametogenesis, mechanism of fertilization, cleavage patterns, Gastrulation, Placentation and Menstruation in Mammals, Extra foeta membranes. Mendel's laws of inheritance, multiple altitudes, linkage and crossing over, sex determination. Sex-linked inheritance Mutations, Operon concept, genetic code Eagenics, Principles of Plant and Animal Breeding; Evidences of evolution of Man, Isolation and Speculation.

**IV. Environmental Biology:** Abiotic and Biotic factors of environment, Biogeochemical cycles, Ecological Succession, Ecosystem, Population ecology, Arboreal, Volany1, Deepsea, Xerophytic, Hydrophilic and epiphytic adaptations, Environmental pollutions, wild Life-conservation.

**V. Microbiology:** Classification and characteristics of microorganisms Physiology and Cultivation of microbes. Microbes in water, soil, air food and seucage. Air, Water, Soil, food and Vector bore diseases prophylactic measures Antigen, Antibody reactions and Principles of immunization.

**VI. Biochemistry & Biotechnology:** Classification of enzymes, coenzymes and vitamins, structure functions and classification of carbohydrates, proteins and lipids and their energy metabolism. Plant and Animal tissue culture techniques, Micro-Propagation, Monoclonal Antibodies, Protoplast culture, DNA sequencing, Recombinant DNA, Applied aspects of Biotechnology in Agriculture, Animal Husbandry, Medicine, disease, diagnosis and Therapy.
Food Science, Nutrition and Dietetics:
Food as a source of nutrients, composition, properties, characteristics, and nutritive value of different foods (cereal grains, millets, pulses, nuts and oil seeds, fruits and vegetables, milk and milk products, meat, egg, poultry, fish, spices and condiments. Chemistry and biochemical roles of fat soluble vitamins, water soluble vitamins, inorganic elements.

1. Energy requirement: Basal metabolism, total energy requirements.
2. Study of Nutrients: (a) Carbohydrates, proteins, fats - chemistry, biochemistry and nutritional aspects such as digestion, absorption, metabolism, functions, sources, requirements, and deficiencies. (b) Vitamins and minerals - functions, sources, requirements, and deficiencies.
4. Methods of assessing the nutritional status.
5. Principles involved in adoption of normal diet for formulating therapeutic diet - use of food exchange groups.
6. Diets during pregnancy, lactation, infancy, school age, adolescent, adulthood and old age.
7. Nutritional deficiency diseases.
8. Diet in diseases (metabolic disorders, febrile conditions, surgical & other stress conditions) - causes, symptoms, physiological changes and dietary management.

For B.Sc. (MPC) students:


Medicinal Chemistry: Introduction and classification of drugs based on site of action (CNS drugs, CVS drugs), site, mode and mechanism of action. Chemotherapy – definition and characteristics (Sulpha drugs and Antibiotic).

Food Science, Nutrition and Dietetics:
Food as a source of nutrients, composition, properties, characteristics, and nutritive value of different foods (cereal grains, millets, pulses, nuts and oil seeds, fruits and vegetables, milk and milk products, meat, egg, poultry, fish, spices and condiments. Chemistry and biochemical roles of fat soluble vitamins, water soluble vitamins, inorganic elements.

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PROFESSIONAL PROGRAMMES

M.B.A. / M.B.A. (Finance)

Admission to M.B.A./M.B.A. (Finance) Programme of the Institute will be based on performance in the Admission Test, Group Discussion and Interview.

There will be three written tests of 3 hours total duration. They would be of a pattern similar to CAT, GMAT and MAT. The details of various tests are as follows:

1. **English:** 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.

2. **Quantitative Analysis & Logical Reasoning:** 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.

3. **Management Aptitude:** 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.

**NOTE:** The Institute reserves the right to allocate successful candidates of these two courses as it deems fit, notwithstanding the preference indicated by the applicant.

Reference Books: Standard books used for CAT/MAT/GMAT Entrance Examinations.

M.Tech. (Computer Science)

Admission Test will have five Components.
1. General English Aptitude Test (20 marks)
2. Written Test in Computer Science and Mathematics (120 Marks)
3. Practical Programming Skills Test (80 Marks)
4. Technical Viva-Voce (30 Marks)
5. Final Interview

1. **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.

2. **Written Test:**
   Duration of the test will be for **2 hours** and it will consist of two main parts viz.
   - **Part A:** Eighty (80) multiple choice/objective type questions for a total of 80 marks with each question carrying one mark to its credit &
   - **Part B:** Eight (8) short answer type questions for a total 40 marks with each question carrying 5 marks to its credit.

**Computer Science:**
- 60 objective type questions one mark each in Part A and 4 short answer questions of 5 marks each in Part B.
- 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.
- CS Total: 80 marks

**Mathematics:**
- 20 objective type questions of one mark each and 4 short answer questions of 5 marks each.
- The subjects to be covered are: ODE, Discrete Mathematics, Linear Algebra, Probability and Statistics and Basic Calculus
- Mathematics Total: 40 marks

The ratio of questions in Computer Science subjects in relation to Mathematics will be **67%: 33%**
The syllabi for the above written tests are as follows:


iii. **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


v. **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.


vii. **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.

viii. **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.

ix. **Discrete Mathematics**: Set theory, Mathematical logic, Relations and functions, Trees and Graphs.

x. **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.

Some Suggested Reference Books:

**Computer Science**

A. Data structures and algorithms in C by Mark Allen Weiss
B. Computer Organization and design by David A. Patterson and John L. Hennessy, Elsevier Pub.
E. Systems programming by Lelend Beck, 3rd edition, Pearson India.
F. C++ How to Program, 4/e by Paul Deitel

**Mathematics**


3. **Programming Skills Test.**

This test will be given to those who qualify in the first two tests: Practical Test will be for 2 and half hours duration for a total of 80 marks. It will test the proficiency in designing, coding and debugging abilities in C language. The coding environment will be in Linux platform.

4. **Oral Test. This test will be given to those who qualify in first two components:**

Oral Test will examine the comprehension of basics and analytical abilities. This part carries 30 marks.

5. **Interview:**

An Interview will be conducted for candidates who qualify in the Practical and Oral test for final selection.
M.Tech. (Optoelectronics and Communications)

Admission Test will have four Components.
1. General English Aptitude Test (20 marks)
2. Written Test (100 Marks)
3. Technical Viva-Voce
4. Final Interview

1. 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.

2. Written Test: Duration of the test will be 3 hours and it will contain an essay in English, multiple choice, short answer and problem solving type questions.

Common for B.E. / B.Tech. / M.Sc.(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.


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.


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.


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. (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: Schrödinger 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.

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M.Tech. (Analytical Methods and Chemical Instrumentation):

Admission Test will have five Components.
1. General English Aptitude Test (20 marks)
2. Written Test (100 Marks)
3. Technical Viva-Voce
4. Final Interview

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.

Written Test: Duration of the test will be 2½ hours and it will contain an essay in English, multiple choice, short answer and problem solving type questions.

Question paper pattern:
1. SECTION A: 50 Marks - Multiple choice: 50 questions each with FIVE alternatives.
2. SECTION B: 30 Marks - Short answer questions: Three out of four. Each question carrying 10 marks.
3. SECTION C: 20 Marks - Long answer question: One with internal choice carrying 20 marks.

Syllabus:

Atomic structure and periodicity: Planck's quantum theory, wave particle duality, uncertainty principle, quantum mechanical model of hydrogen atom; electronic configuration of atoms; periodic table and periodic properties; ionization energy, election affinity, electronegativity, atomic size.

Structure and bonding: Ionic and covalent bonding, M.O. and V.B. approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridisation, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding, van der Waals interactions. Ionic solids, ionic radii, lattice energy (Born-Haber Cycle).

s.p. and d Block Elements: Oxides, halides and hydrides of alkali and alkaline earth metals, B, Al, Si, N, P, and S, general characteristics of 3d elements, coordination complexes: valence bond and crystal field theory, color, geometry and magnetic properties.
Chemical Equilibria: Colligative properties of solutions, ionic equilibria in solution, equilibrium constants (Kc, Kp and Kx) for homogeneous reactions.

Electrochemistry: Conductance, Kohlrausch law, Half Cell potentials, emf, Nemst equation, galvanic cells, thermodynamic aspects and their applications.

Reaction Kinetics: Rate constant, order of reaction, molecularity, activation energy, zero, first and second order kinetics, catalysis and elementary enzyme reactions.

Thermodynamics: First law, reversible and irreversible processes, internal energy, enthalpy, Kirchhoff's equation, heat of reaction, Hess law, heat of formation, Second law, entropy, free energy, and work function. Gibbs-Helmholtz equation, Clausius-Clapeyron equation, free energy change and equilibrium constant, Troutons rule, Third law of thermodynamics.


Structure-Reactivity Correlations: Acids and bases, electronic and steric effects, optical and geometrical isomerism, tautomerism, conformers, concept of aromaticity.

Carbonyl compounds: Nomenclature-nature of carbonyl groups - preparation of aldehydes and ketones. General mechanism of Nucleophilic addition-C,S,O and N-nucleophiles- General features to be highlighted - Mechanisms of bisulphite addition, cyanohydrin reaction, Cannizzaro reaction, crossed aldol condensation, benzoin condensation using KCN and also Thiamine hydrochloride.

Analytical Chemistry: Non aqueous solvents- comparison of the solvent characteristics of liquid ammonia and liquid SO2 with water - Different types of reactions in each solvent system.

Solubility of substances: - Mechanism of solvation - Chemical interactions involved, activity, activity coefficients, ionic strength of electrolytes, electrolytic dissociation –weak and strong electrolytes.


Sparingly soluble salts - solubility product principle - calculation of solubility and solubility product- Application of the solubility product principle and common ion effect in qualitative inorganic analysis to be illustrated with examples.

Complex ions: Formation, consequences of complex formation - Importance of complex ion formation in qualitative inorganic analysis.

Salt hydrolysis - interaction of salts with water: Hydrolysis of salts - hydrolysis constant, degree of hydrolysis - Derivation of expressions for pH of aqueous solution of different types of salts.

Buffers - concept, buffer components, mechanism of buffer action, types of buffers, preparation of buffers - Henderson's equation, buffer capacity, importance of buffers.


standards, examples -Theoretical principles involved in titrimetric analysis using neutralization and redox reactions – neutralization curves – Potentiometric titration curve.

Theory of indicators for neutralization indicators -Theory of indicators for red-ox indicators - Basic discussion of types of indicators - internal and external, self-indicator, pH indicators, redox indicators with suitable examples.

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M.Tech. (Nuclear Medicine)

Admission Test will have five Components.

1. General English Aptitude Test (20 marks)
2. Written Test (120 Marks)
3. Technical Viva-Voce
4. Final Interview

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.

Written Test: Duration of the test will be 2½ hours and it will contain an essay in English, multiple choice, short answer and problem solving type questions.

Question Paper Pattern: Paper I: Common Paper: 30 Multiple Choice Questions: 60 Minutes; Paper II: Subject of study: 30 Multiple Choice questions in the subject of study and choice: 60 Minutes.
1) Syllabus for Common Paper

Computer awareness and scientific aptitude:
Computer awareness: History of computers, history of computers, computer classification, Classification based on size and capability, Basic knowledge of computer systems, software and programming.

General awareness and scientific aptitude:
Chemistry: Quantum numbers, Periodic table, Electronegativity, group 1 elements, group 2 elements, group 13 elements, group 14 elements, group 16 elements, group 17 elements, group 18 elements, transition elements, hydrocarbons, biomolecules, carbohydrates, amino acids, proteins, nucleic acids, mutation, vitamins.
Geography: core of earth, volcanoes, earthquakes, atmosphere, troposphere, ozonosphere, stratosphere, ionosphere, mesosphere, exosphere, ozone, global warming and green-house effect, rocks, minerals, some facts about soils, soils of India.
Mathematics: binomial theorem, progressions, some standard limits, median, harmonic mean, mode, probability.
Physics: Projectile motion, collisions, Newton’s law of gravitation, Kepler’s laws, moment of inertia, Hooke’s law, angular momentum, escape velocity, simple harmonic motion, normal modes; special theory of relativity - Lorentz transformations, relativistic kinematics, mass-energy equivalence.

2A) For M.Sc. Physics Applicants

Mathematical Physics: Linear vector space; matrices; vector calculus; linear differential equations; elements of complex analysis; Laplace transforms, Fourier analysis, elementary ideas about tensors.
Classical Mechanics: Conservation laws; central forces, Kepler problem and planetary motion; collisions and scattering in laboratory and centre of mass frames; mechanics of system of particles; rigid body dynamics; moment of inertia tensor; noninertial frames and pseudo forces; variational principle; Lagrange’s and Hamilton’s formalisms; equation of motion, cyclic coordinates, Poisson bracket; periodic motion, small oscillations, normal modes; special theory of relativity - Lorentz transformations, relativistic kinematics, mass-energy equivalence.
Electromagnetic Theory: Solution of electrostatic and magnetostatic problems including boundary value problems; dielectrics and conductors; Biot-Savart’s and Ampere’s laws; Faraday’s law; Maxwell’s equations; scalar and vector potentials; Coulomb and Lorentz gauges; Electromagnetic waves and their reflection, refraction, interference, diffraction and polarization. Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves; radiation from a moving charge.
Quantum Mechanics: Physical basis of quantum mechanics; uncertainty principle; Schrodinger equation; one, two and three dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta; time independent perturbation theory; elementary scattering theory.
Thermodynamics and Statistical Physics: Laws of thermodynamics; macro-states and microstates; phase space; probability ensembles; partition function, free energy, calculation of thermodynamic quantities; classical and quantum statistics; degenerate Fermi gas; black body radiation and Planck’s distribution law; Bose-Einstein condensation; first and second order phase transitions, critical point.

Atomic and Molecular Physics: Spectra of one- and many-electron atoms; LS and jj coupling; hyperfine structure; Zeeman and Stark effects; electric dipole transitions and selection rules; X-ray spectra; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR; lasers.
Solid State Physics: Elements of crystallography; diffraction methods for structure determination; bonding in solids; elastic properties of solids; defects in crystals; lattice vibrations and thermal properties of solids; 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: Nuclear radii and charge distributions, nuclear binding energy, Electric and magnetic moments; nuclear models, liquid drop model - semi-empirical mass formula, Fermi gas model of nucleus, nuclear shell model; nuclear force and two nucleon problem; Alpha decay, Beta-decay, electromagnetic transitions in nuclei; Rutherford scattering, nuclear reactions conservation laws; fission and fusion; particle accelerators and detectors; elementary particles, photons, baryons, mesons and leptons; quark model.
Electronics: Network analysis; semiconductor devices; Bipolar Junction Transistors, Field Effect Transistors, amplifier and oscillator circuits; operational amplifier, negative feedback circuits, active filters and oscillators; rectifier circuits, regulated power supplies; basic digital logic circuits, sequential circuits, flip-flops, counters, registers, A/D and D/A conversion.

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Physical Chemistry:

Structure: Quantum theory: principles and techniques; applications to a particle in a box, harmonic oscillator, rigid rotor and hydrogen atom; valence bond and molecular orbital theories, Hückel approximation; approximate techniques: variation and perturbation; symmetry, point groups; rotational, vibrational, electronic, NMR, and ESR spectroscopy.

Equilibrium: Kinetic theory of gases; First law of thermodynamics, heat, energy, and work; second law of thermodynamics and entropy; third law and absolute entropy; free energy; partial molar quantities; ideal and non-ideal solutions; phase transformation: phase rule and phase diagrams – one, two, and three component systems; activity, activity coefficient, fugacity, and fugacity coefficient; chemical equilibrium, response of chemical equilibrium to temperature and pressure; colligative properties; Debye–Hückel theory; thermodynamics of electrochemical cells; standard electrode potentials: applications – corrosion and energy conversion; molecular partition function (translational, rotational, vibrational, and electronic).

Kinetics: Rates of chemical reactions, temperature dependence of chemical reactions; elementary, consecutive, and parallel reactions; steady state approximation; theories of reaction rates – collision and transition state theory, relaxation kinetics, kinetics of photochemical reactions and free radical polymerization, homogeneous catalysis, adsorption isotherms and heterogeneous catalysis.

Inorganic Chemistry:

Main group elements: General characteristics, allotropes, structure and reactions of simple and industrially important compounds: boranes, carboranes, silicones, silicates, boron nitride, borazines and phosphazenes. Hydrides, oxides and oxoacids of pnictogens (N,P), chalcogens (S, Se & Te) and halogens, xenon compounds, pseudo halogens and interhalogen compounds. Shapes of molecules and hard-soft acid base concept. Structure and Bonding (VBT) of B, Al, Si, N, P, S, Cl compounds. Allotropes of carbon: graphite, diamond, C60. Synthesis and reactivity of inorganic polymers of Si & P.

Transition Elements: General characteristics of d and f block elements; coordination chemistry: structure and isomerism, stability, theories of metal- ligand bonding (CFT and LFT), mechanisms of substitution and electron transfer reactions of coordination complexes. Electronic spectra and magnetic properties of transition metal complexes, lanthanides and actinides. Metal carbonyls, metal- metal bonds and metal atom clusters, metalloccenes; transition metal complexes with bonds to hydrogen, alkyls, alkenes and arenes; metal carbenes; use of organometallic compounds as catalysts in organic synthesis. Bioinorganic chemistry of Na, K, Mg, Ca, Fe, Co, Zn, Cu and Mo.

Solids: Crystal systems and lattices, miller planes, crystal packing, crystal defects; Bragg’s Law, ionic crystals, band theory, metals and semiconductors. Different structures of AX, AX2, ABX3 compounds, spinels.

Instrumental methods of analysis: Atomic absorption and emission spectroscopy including ICP-AES, UV-visible spectrophotometry, NMR, mass, Mossbauer spectroscopy (Fe and Sn), ESR spectroscopy, chromatography including GC and HPLC and electro-analytical methods (Coulometry, cyclic voltammetry, polarography – amperometry, and ion selective electrodes).

Organic Chemistry:

Stereochemistry: Chirality of organic molecules with or without chiral centres. Specification of configuration in compounds having one or more stereogeniccentres. Enantiotopic and diastereotopic atoms, groups and faces. Stereoselective and stereospecific synthesis. Conformational analysis of acyclic and cyclic compounds. Geometrical isomerism. Configurational and conformational effects on reactivity and selectivity/specificity.


Organic synthesis: Synthesis, reactions, mechanisms and selectivity involving the following- alkenes, alkynes, arenes, alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives, halides, nitro compounds and amines. Use of compounds of Mg, Li, Cu, B and Si in organic synthesis. Concepts in multistep synthesis - retrosynthetic analysis, disconnections, synthons, synthetic equivalents, reactivity umpolung, selectivity, protection and deprotection of functional groups.

Pericyclic reactions: Electroyclic, cycloaddition and sigmatropic reactions. Orbital correlation, FMO and PMO treatments.


Heterocyclic compounds: Structure, preparation, properties and reactions of furan, pyrrole, thiophene, pyridine, indole and their derivatives.

Biomolecules: Structure, properties and reactions of mono- and di-saccharides, physicochemical properties of amino acids, chemical synthesis of peptides, structural features of proteins, nucleic acids, steroids, terpenoids, carotenoids, and alkaloids.
Spectroscopy: Principles and applications of UV-visible, IR, NMR and Mass spectrometry in the determination of structures of organic molecules.

2C) For M.Sc. Life Sciences Applicants

Chemistry: Atomic structure and periodicity: Planck’s quantum theory, wave particle duality, uncertainty principle, quantum mechanical model of hydrogen atom; electronic configuration of atoms; periodic table and periodic properties; ionization energy, electron affinity, electronegativity, atomic size.

Structure and bonding: Ionic and covalent bonding, M.O. and V.B. approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridisation, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding, van der Waals interactions. Ionic solids, ionic radii, lattice energy (Born-Haber Cycle).

s.p. and d Block Elements: Oxides, halides and hydrides of alkali and alkaline earth metals, B, Al, Si, N, P, and S, general characteristics of 3d elements, coordination complexes: valence bond and crystal field theory, color, geometry and magnetic properties.

Chemical Equilibria: Coligative properties of solutions, ionic equilibria in solution, solubility product, common ion effect, hydrolysis of salts, pH, buffer and their applications in chemical analysis, equilibrium constants (Kc, Kp and Kx) for homogeneous reactions.

Electrochemistry: Conductance, Kohlraush law, Half Cell potentials, emf, Nernst equation, galvanic cells, thermodynamic aspects and their applications.

Reaction Kinetics: Rate constant, order of reaction, molecularity, activation energy, zero, first and second order kinetics, catalysis and elementary enzyme reactions.

Thermodynamics: First law, reversible and irreversible processes, internal energy, enthalpy, Kirchhoff’s equation, heat of reaction, Hess law, heat of formation, Second law, entropy, free energy, and work function. Gibbs-Helmholtz equation, Clausius-Clapeyron equation, free energy change and equilibrium constant, Troutons rule, Third law of thermodynamics.


Structure-Reactivity Correlations: Acids and bases, electronic and steric effects, optical and geometrical isomerism, tautomerism, conformers, concept of aromaticity


Cells of the immune system: T, B and macrophages. T and B cell activation. Major histocompatibility complex. T cell receptor. Immunological techniques: Immunodiffusion, immunoelectrophoresis, RIA and ELISA.

Botany:

Plant Systematics: Systems of classification (non-phylogenetic vs. phylogenetic – outline), plant groups, molecular systematics.

Plant Anatomy: Plant cell structure, organization, organelles, cytoskeleton, cell wall and membranes; anatomy of root, stem and leaves, meristems, vascular system, their ontogeny, structure and functions, secondary growth in plants and stellar organization.

Morphogenesis & Development: Cell cycle, cell division, life cycle of an angiosperm, pollination, fertilization, embryogenesis, seed formation, seed storage proteins, seed dormancy and germination. Concept of cellular totipotency, clonal propagation; organogenesis and somatic embryogenesis, artificial seed, somacclonal variation, secondary metabolism in plant cell culture, embryo culture, in vitro fertilization.

Physiology and Biochemistry: Plant water relations, transport of minerals and solutes, stress physiology, stomatal physiology, signal transduction, N2 metabolism, photosynthesis, photospiration; respiration, Flowering: photoperiodism and vernalization, biochemical mechanisms involved in flowering; molecular mechanism of senescence and aging, biosynthesis, mechanism of action and physiological effects of plant growth regulators, structure and function of biomolecules, (proteins, carbohydrates, lipids, nucleic acid), enzyme kinetics.
Genetics: Principles of Mendelian inheritance, linkage, recombination, genetic mapping; extrachromosomal inheritance; prokaryotic and eukaryotic genome organization, regulation of gene expression, gene mutation and repair, chromosomal aberrations (numerical and structural), transposons.


Economic Botany: A general account of economically and medicinally important plants - cereals, pulses, plants yielding fibers, timber, sugar, beverages, oils, rubber, pigments, dyes, gums, drugs and narcotics. Economic importance of algae, fungi, lichen and bacteria.

Plant Pathology: Nature and classification of plant diseases, diseases of important crops caused by fungi, bacteria and viruses, and their control measures, mechanism(s) of pathogenesis and resistance, molecular detection of pathogens; plant-microbe beneficial interactions.

Ecology and Environment: Ecosystems – types, dynamics, degradation, ecological succession; food chains and energy flow; vegetation types of the world, pollution and global warming, speciation and extinction, conservation strategies, cryopreservation, phytoremediation.

Microbiology:

Historical Perspective: Discovery of microbial world; Landmark discoveries relevant to the field of microbiology; Controversy over spontaneous generation; Role of microorganisms in transformation of organic matter and in the causation of diseases.

Methods in Microbiology: Pure culture techniques; Theory and practice of sterilization; Principles of microbial nutrition; Enrichment culture techniques for isolation of microorganisms; Light-, phase contrast- and electron-microscopy.

Microbial Taxonomy and Diversity: Bacteria, Archea and their broad classification; Eukaryotic microbes: Yeasts, molds and protozoa; Viruses and their classification; Molecular approaches to microbial taxonomy.


Microbial Growth: Definition of growth; Growth curve; Mathematical expression of exponential growth phase; Measurement of growth and growth yields; Synchronous growth; Continuous culture; Effect of environmental factors on growth.

Control of Micro-organisms: Effect of physical and chemical agents; Evaluation of effectiveness of antimicrobial agents.

Microbial Metabolism: Energetics: redox reactions and electron carriers; An overview of metabolism; Glycolysis; Pentose-phosphate pathway; Entner-Doudoroff pathway; Glyoxalate pathway; The citric acid cycle; Fermentation; Aerobic and anaerobic respiration; Chemolithotrophy; Photosynthesis; Calvin cycle; Biosynthetic pathway for fatty acids synthesis; Common regulatory mechanisms in synthesis of amino acids; Regulation of major metabolic pathways.

Microbial Diseases and Host Pathogen Interaction: Normal microbiota; Classification of infectious diseases; Reservoirs of infection; Nosocomial infection; Emerging infectious diseases; Mechanism of microbial pathogenicity; Nonspecific defense of host; Antigens and antibodies; Humoral and cell mediated immunity; Vaccines; Immune deficiency; Human diseases caused by viruses, bacteria, and pathogenic fungi.

Chemotherapy/Antibiotics: General characteristics of antimicrobial drugs; Antibiotics: Classification, mode of action and resistance; Antifungal and antiviral drugs.

Microbial Genetics: Types of mutation; UV and chemical mutagens; Selection of mutants; Ames test for mutagenesis; Bacterial genetic system: transformation, conjugation, transduction, recombination, plasmids, transposons; DNA repair; Regulation of gene expression: repression and induction; Operon model; Bacterial genome with special reference to E.coli; Phage λ and its life cycle; RNA phages; RNA viruses; Retroviruses; Basic concept of microbial genomics.

Microbial Ecology: Microbial interactions; Carbon, sulphur and nitrogen cycles; Soil microorganisms associated with vascular plants.

Zoology:

Animal world: Animal diversity, distribution, systematics and classification of animals, phylogenetic relationships.


Genetics: Principles of inheritance, molecular basis of heredity, mutations, cytoplasmic inheritance, linkage and mapping of genes.

Biochemistry and Molecular Biology: Nucleic acids, proteins, lipids and carbohydrates; replication, transcription and translation; regulation of gene expression, organization of genome, Kreb's cycle, glycolysis, enzyme catalysis, hormones and their actions, vitamins.
Cell Biology: Structure of cell, cellular organelles and their structure and function, cell cycle, cell division, chromosomes and chromatin structure. Eukaryotic gene organization and expression (Basic principles of signal transduction).

Animal Anatomy and Physiology: Comparative physiology, the respiratory system, circulatory system, digestive system, the nervous system, the excretory system, the endocrine system, the reproductive system, the skeletal system, osmoregulation.

Parasitology and Immunology: Nature of parasite, host-parasite relation, protozoan and helminthic parasites, the immune response, cellular and humoral immune response, evolution of the immune system.

Development Biology: Embryonic development, cellular differentiation, organogenesis, metamorphosis, genetic basis of development, stem cells.

Ecology: The ecosystem, habitats, the food chain, population dynamics, species diversity, zoogeography, biogeochemical cycles, conservation biology.

Animal Behaviour: Types of behaviours, courtship, mating and territoriality, instinct, learning and memory, social behaviour across the animal taxa, communication, pheromones, evolution of animal behavior.

2D) For M.Sc.(Nanoscience & Nanotechnology) Applicants

Mathematical Methods for Nanoscience: Curvilinear coordinates: Transformation of coordinates; orthogonal curvilinear coordinates; Gradient, divergence and curl; Partial Differential equations: The method of separation of variables: Separation of Laplace and Helmholtz equations in Cartesian, Spherical polar and Cylindrical polar coordinates; Vector Spaces: Linear transformations and matrices; Types of matrices and their properties: Eigen-value problems: Determination of eigen values and eigenvectors matrices referred above; Diagonalization and applications, Complex Numbers: complex functions, analytic function; properties of complex numbers; Fundamentals of Probability: probability theorems; conditional probability; Bayes’ formula; counting, permutations and combinations; Random variables; mean, standard deviation, variance; Distribution functions; Binomial, Gaussian and Poisson distributions.

Quantum Mechanics: Postulates of Quantum mechanics - Schrodinger's equation - Comparison with the Classical Hamiltonian equation - Significance of wave function - Eigen functions and Eigen values, their characteristics, normalization and orthogonality, probability distribution functions., Application of Schrodinger's equation to the particle in a box (one-dimensional and three dimensional) with complete solution - average values- expression for quantum mechanical tunneling; Rigid rotator, Harmonic oscillator and Schrodinger equation for the hydrogen atom – Quantum numbers and their characteristics - Diagrams of orbital wave functions and probability distribution functions – their significance The variational method and perturbation theory.

Nanoscience: Introduction to Nanoscience: History and Scope, Interdisciplinary nature, Nanoparticles: Nanoclusters, nanocrystals (different types), Core-shell nanoparticles, Synthesis, Nanoscale phenomena and properties of nanoparticles.

Physical: de Broglie wavelength & exciton Bohr radius, jellium model, Electronic and electrical: Density of States, Quantum Effects, quantum structures: wells, wires, dots; Role of size, shape and energy considerations, Optical: Surface plasmon, fluorescence, Magnetic: Superparamagnetism, Chemical: Surface to volume ratio, Surface energy.


Circular dichroism and optical rotatory dispersion: Principles of optical activity, cotton effect, relation between CD and ORD; Linear dichroism of biological polymers; Use of circular dichroism in protein analysis.

Nanomaterials: Applications and Devices: Fabrication at the nanoscale: Lithography methods, Limitations of optical, X-ray, electron and ion beam fabrication methods, Lithographic techniques, Scanning probe based techniques, Nanomaterials of chemical and biological origin: Formation and characterization of polymers, Conductive polymers and application, supramolecular structures; Bio -Functionalization of nanomaterials; Bio synthesis- Bacteria as bio synthesizer, Bioderived and Bio-Inspired Materials, Bio templates Nanomaterials for Biological applications: Quantum dots fluorescence and use as bio-markers, Near Field Bioimaging, Nanoparticles for Optical diagnostics and Targeted Drug Delivery, Quantum Dots for bioimaging, Upconverting Nanophores for Bioimaging, Biosensing, Nanoclincs- Gene Delivery and Photodynamic Therapy, Nanomaterials for Optoelectronic Applications: Nanocomposites: Photonic media,


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B.Ed.

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

General English and Aptitude Test

- **Test 1:** This will consist of two sub-tests of 80 minutes duration and for 65 marks.
  - **Sub-test: 1(a): General English – 30 marks - 40 minutes:** This sub-test is designed to test the candidate's knowledge and her command over English language and language skills.
  - **Sub-test 1(b): Situation Analysis - 35 marks - 40 minutes:** The purpose of this sub-test is to assess the candidate's ability to analyse a given situation in all its implications and, her capacity to respond to different problems and value issues raised.

- **Test 2:** This test will consist of two papers on the core subjects studied in the qualifying degree.
  - **The test will be of 100 minutes duration and for 100 marks (50+50):** This test is designed to assess and evaluate candidate's knowledge in two specific subjects in teaching methodology. For this purpose, candidates have to choose any two papers from the following which they have studied in the qualifying degree:

  **Students with Postgraduate qualification:**
  Mathematics and Physics; Mathematics and Chemistry; Physics and Chemistry; English and Social Studies; English and History; English and Civics; English and Geography.

  **Students with Undergraduate qualification:**
  Mathematics and Physical Sciences; Biological Sciences and English; Social Studies and English.

  

M.Ed.

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

**Pattern of the Question Paper:** There will be two papers which are compulsory viz., Paper-I – General English of 50 marks for one hour duration, and Paper-II – related to B.Ed curriculum consisting of objective questions of 100 marks for 1½ hours duration. Total duration of the test is 2 and ½ hours with 150 marks.

**Syllabus:**

Paper-I: General English (One hour) – 50 marks.

Paper-II: Education (One and half hours) – 100 marks.

* Philosophical & Sociological foundations of Education (20 marks)
* Psychological foundations of Education (20 marks)
* Educational Technology (20 marks)
* School Administration, Planning & Management (20 marks)
* Educational Evaluation & Elementary Statistics (20 marks)

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