Syllabus for the M. Sc. (Informatics) Entrance Examination

The entrance examination will consist of a multiple-choice question paper of 3 hours duration having two parts.

Part I: General English Comprehension; Analytical Ability and Reasoning.
Part II: Mathematics, Physics, Electronics and Basic knowledge of Computers.
Though there is no fixed syllabus for the entrance test, a broad outline of the syllabus is suggested below.

PART- I

Vocabulary , Comprehension & Analytical Ability and Reasoning:
This part is intended to test the candidate's vocabulary and analytical skills at a level essential for accurate comprehension and presentation of material appropriate for this degree. The language background expected will be of the level of English at Senior Secondary Examination. The paper will include passages for comprehension, test of vocabulary (synonyms and antonyms), elementary grammar and syntax.
The section on Analytical Ability and Reasoning will include standard questions on pattern recognition, logic, Venn diagrams etc. It is not intended to be subject-specific.

PART- II

Mathematics, Physics, Electronics and Basic knowledge of Computer

MATHEMATICS

Scalar and vector fields, tangent and normal vectors, gradient, divergence, curl, vector identities, Gauss, Stokes' and Green's theorem. Convergent and divergent sequences and series, tests for convergence and divergence, absolute and conditional convergence. Limits, continuity and differentiability of functions. Solutions of first and second order linear homogeneous differential equations. Partial differential equations, separation of variable method. Vibrations of rectangular membranes. Systematic and random errors, Normal law of error. Least square fitting of data (linear case). Fourier series, Fourier transform, Sine and cosine transform, convolution theorem. Laplace transform: transforms of elementary functions and solution of simple differential equations. Matrix algebra. Singular and non-singular matrices. Inverse of a matrix. Eigenvalues and eigenvectors, Hermitian and skew-hermitian, symmetric and antisymmetric, orthogonal and unitary matrices. Similarity transformation, Cayley-Hamilton theorem. Definitions of random sample, parameter, and statistics. Concept of sampling distribution and standard error. Sampling distribution of mean and variance of a random sample from a normal population. Tests of significance. Complex variables: residues, poles, Cauchy's theorem.

PHYSICS

Motion of a charged particle in electric and magnetic fields. Conservation of momentum. Conservative and nonconservative forces. Motion involving both translation and rotation. Motion of a particle under a central force field. Inertial and noninertial frames, fictitious forces. Postulates of special relativity, Lorentz transformation, relativistic transformation of velocity, frequency, energy and momentum. Maxwell's law of distribution of velocities, mean free path. Transport phenomena: viscosity, conduction and diffusion. Brownian motion. Magnetic force between current elements, Ampere's law. Torque on a current loop in a uniform magnetic field. Faraday's law of induction, self and mutual induction, energy stored in electric and magnetic field, B-H curve, and energy loss in hysteresis. Maxwell's equations, wave equation, plane waves in dielectric media. Polarization of e.m. waves; linear, circular and elliptical polarization. Light propagation in uniaxial crystals, double refraction. Modes in rectangular waveguides, energy flow and attenuation in waveguides.

Interference, division of amplitude and wavefront. Concept of laser. Photoelectric effect, Compton effect, wave particle duality, wave packet. Two-slit experiment with electrons. Wave amplitude and wave functions, uncertainty principle, Schrodinger's equation, probabilistic interpretation. Stationary states, one- dimensional simple harmonic oscillator, infinite and finite potential well. Orbital angular momentum and azimuthal quantum numbers, and space quantization. X-ray diffraction and Bragg's Law.

ELECTRONICS AND BASIC KNOWLEDGE OF COMPUTERS

Network analysis: Kirchoff's current & voltage law, Norton & Thevenin's theorems (Poles & Zeroes, Mesh and node analysis). Basic features of semiconductor material, diode, transistor, FET, MOSFET and SCR and their applications (rectifier, waveshaping, amplifier & oscillators). Concept of feedback. OP-AMPS & their simple applications, integration, differentiation. Boolean algebra, n-array arithmetics (binary, octal, hexadecimal, 1's complement 2's complement). Logic families (RTL, DTL, DCTL, TTL), K-map. Combinational circuits (Adder, Subtractor, MUX, DEMUX), look-ahead carry concept, sequential circuits, flip-flops, registers, counters and memories, A/D &D/A converters. Basic idea of modulation & demodulation; AM, FM, PPM, PWM and PAM. Elementary ideas of satellite communication. Multimeters (analog & digital), Q-meter, frequency meter. Basic architecture of 8 bit microprocessors,assembly language and simple programs based on assembly language, interrupts and timimg diagrams. Computer basics, data representation, input/output units, compiler, memory, micro-processor, computer architecture. Fundamentals of high level languages. Disk Operating System (DOS). Computer generations and classifications