

DA-IICT Gandhinagar, India

M.Sc. (Data Science)

Syllabus for Entrance Test

The entrance examination will primarily check basic aptitude in mathematics and statistics, understanding of algorithms and programming, and the ability to logically interpret data. Entrance test will consist of multiple choice questions from the following four sections.

Section I - Quantitative Aptitude: Logical Reasoning and Verbal Ability.

Section II: Computer Science

Data structures: Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Programming concepts: arithmetic, logical, bitwise and conditional operators, iteration, recursion, object oriented programming

Algorithms: Searching, sorting, asymptotic worst case time and space complexity, algorithm design techniques: greedy, dynamic programming and divide-and-conquer, linear search, binary search, graph search, minimum spanning trees, shortest paths.

Section III: Mathematics

Sequences and Series of real numbers: Sequences of real numbers, convergence of sequences, bounded and monotone sequences, convergence criteria for sequences of real numbers, Cauchy sequences, subsequences, Bolzano-Weierstrass theorem, Series of real numbers, absolute convergence, tests of convergence for series of positive terms: comparison test, ratio test, root test; alternating series: Libnitz test for convergence of alternating series

Functions of one real variable: Limit, continuity, intermediate value property, differentiation, Rolle 's theorem, mean value theorem, L'Hospital rule, Taylor's theorem, maxima and minima

Functions of two or three variables: Limit, continuity, partial derivatives, directional derivative, differentiability, maxima and minima

Integral calculus: Integration as the inverse process of differentiation, definite integrals and their properties, fundamental theorem of calculus, double and triple integrals, change of order of integration, calculating surface areas and volumes using double integrals, triple integrals

Differential equations: Ordinary differential equations of first order: linear equations, Bernoulli's equation, exact differential equations, integrating factor, orthogonal trajectories; homogeneous differential equations, linear second order differential equations with constant coefficients, method of variation of parameters for nonhomogeneous equations, Cauchy-Euler equation

Linear algebra: Finite dimensional vector spaces, linear independence of vectors, basis, dimensions, linear transformations, matrix representation, range space, null space, rank-nullity theorem, rank and inverse of a matrix, determinant, solutions of systems of linear equations, consistency conditions, eigenvalues and eigenvectors for matrices, Caley-Hamilton theorem.

Section IV: Statistics

Probability: Axiomatic definition of probability and properties, conditional probability, multiplication rule. Theorem of total probability. Bayes' theorem and independence of events.

Random Variables: Probability mass function, probability density function and cumulative distribution functions, distribution of a function of a random variable. Mathematical expectation, moments and moment generating function. Chebyshev's inequality.

Standard Distributions: Binomial, negative binomial, geometric, Poisson, hypergeometric, uniform, exponential, gamma, beta and normal distributions. Poisson and normal approximations of a binomial distribution.

Joint Distributions: Joint, marginal and conditional distributions. Distribution of functions of random variables. Joint moment generating function. Product moments, correlation, simple linear regression. Independence of random variables.

Limit Theorems: Weak law of large numbers. Central limit theorem (i.i.d. with finite variance case only).