MATHEMATICAL STATISTICS (MS)

The Mathematical Statistics (MS) test paper comprisesof Mathematics (40% weightage) and Statistics (60%weightage).

Mathematics:

Sequences and Series: Convergence of sequences of real numbers, Comparison, root and ratio tests for convergence of series of real numbers.

Differential Calculus: Limits, continuity and differentiability of functions of one and two variables. Rolleâ€™s theorem, mean value theorems, Taylor â€™s theorem, indeterminate forms, maxima and minima of functions of one and two variables.

Integral Calculus: Fundamental theorems of integral calculus. Double and triple integrals, applications of definite integrals, arc lengths, areas and volumes. Matrices: Rank, inverse of a matrix. systems of linear equations. Linear transformations, eigenvalues and eigenvectors. Cayley-Hamilton theorem, symmetric, skewsymmetric and orthogonal matrices.

Differential Equations: Ordinary differential equations of the first order of the form yâ€™ = f(x,y). Linear differential equations of the second order with constant coefficients.

Statistics Probability: Axiomatic definition of probability and properties, conditional probability, multiplication rule. Theorem of total probability. Bayesâ€™ 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. Chebyshevâ€™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. Product moments, correlation, simple linear regression. Independence of random variables.

Sampling distributions: Chi-square, t and F distributions, and their properties.

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

Estimation: Unbiasedness, consistency and efficiency of estimators, method of moments and method of maximum likelihood. Sufficiency, factorization theorem. Completeness, Rao-Blackwell and Lehmann-Scheffe theorems, uniformly minimum variance unbiased estimators. Rao-Cramer inequality. Confidence intervals for the parameters of univariate normal, two independent normal, and one parameter exponential distributions.

Testing of Hypotheses: Basic concepts, applications of Neyman-Pearson Lemma for testing simple and composite hypotheses. Likelihood ratio tests for parameters of univariate normal distribution.