

Faculty of Science

M.Sc. / M.A. (Operations Research)

DEPARTMENT OF STATISTICS & OPERATIONS RESEARCH ALIGARH MUSLIM UNIVERSITY ALIGARH

Syllabus for M.A./M.Sc. Entrance Test in Operations Research 2019-2020 onwards

Descriptive Statistics: Concepts of population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement- nominal, ordinal, interval and ratio. Measures of Central Tendency and Measures of Dispersions, Skewness and Kurtosis, Bi-variate data, Correlation (simple, partial and multiple), rank correlation. and Regression Analysis. Principle of least squares and fitting of polynomials and exponential curves

Probability and Probability Distributions: Basics of Probability, conditional Probability, Bayes' theorem and its applications. Random variables, p.m.f, p.d.f. and c.d.f., illustrations and properties of random variables, uni-variate transformations with illustrations. Two dimensional random variables: joint, marginal and conditional p.m.f, p.d.f., and c.d.f., independence of variables. Mathematical expectation and generating functions, characteristic function. Conditional expectations. Standard probability distributions (discrete and continuous) with their properties. Central Limit Theorem. and Chebeshev's In-equality, Tests of significance based on *t*, *Z*, *F* and *Chi-square* distributions.

Statistical Inference: Estimation: Estimate and estimator, Properties of good estimator- unbiasedness, sufficiency, consistency and efficiency. Factorization theorem. Complete statistic, Minimum variance unbiased estimator (MVUE), Rao-Blackwell and Cramer-Rao inequality and their applications. Methods of Estimation, Testing of hypothesis: Null and alternative hypotheses (simple and composite), Type-I and Type-II errors, critical region, level of significance, size and power, best critical region, most powerful test-Neyman Pearson Lemma

Survey Sampling: Concept of sample and population, complete enumeration versus sampling, sampling and non-sampling errors, requirements of a good sample, simple random sampling with and without replacement and basic Sampling Methods (SRS, Systematic stratified).

Statistical Quality Control: Concept of quality Control, Causes of variations, Control Charts for variables and attributes-Xbar, Range, S, p, np and C -Charts, Process Control and Process capability index, Consumer's and producer's risks. Acceptance Sampling Plans- Single and Double)

Linear Programming Problem: Linear Programming Problem, Mathematical formulation of the L.P.P, graphical solutions of a L.P.P. Simplex method for solving L.P.P. Charne's M-technique for solving L.P.P. involving artificial variables. Special cases of L.P.P. Concept of Duality in L.P.P: Dual simplex method. Post-optimality analysis.

Transportation Problem (T.P.) and Assignment Problem (A.P.): Mathematical formulation of T.P., Initial solution by North West corner rule, Least cost method and Vogel's approximation method (VAM), MODI's method to find the optimal solution, special cases of transportation problem. Assignment problem: Hungarian method to find optimal assignment, special cases of assignment problem.

Game theory and Sequencing Problem: Rectangular game, minimax-maximin principle, solution to rectangular game using graphical method, dominance and modified dominance property to reduce the game matrix and solution to rectangular game with mixed strategy. Networking: Shortest route and minimal spanning tree problem. Sequencing Problems: The sequencing Problems with n-jobs and two machines; Optimal sequencing algorithm; Problems with n-jobs and three machines. Problems with n-jobs and m-machines.

Calculus: Real valued sequences and series, convergence / divergence of sequences and series, comparison test, real valued functions, limit and continuity, power series, Differential and Integral Calculus - Differentiability, Rolle's theorem, Mean value theorem and Taylor / Maclaurin expansions, higher order derivatives and partial derivatives, maxima and minima of functions of one variable.

Elements of Linear Algebra: Vector space, subspace, dimension of a vector space, real valued matrices, rank, determinant and inverse of a matrix, properties of square, diagonal and symmetric matrices, characteristic roots and vectors of a matrix, simultaneous linear equations.