ALIGARH MUSLIM UNIVERSITY, ALIGARH

FACULTY OF SCIENCE

SYLLABUS FOR

M.Sc./M.A (Statistics)/ M.Sc./M.A. (Operations Research)/ M.Sc. (Data Science)

Section I: Logical and Analytical Reasoning (15 Questions)

Quantitative aptitude; logical reasoning and problem-solving; analytical and critical thinking. Logical, analytical, and mathematical reasoning. Verbal and non-verbal reasoning.

Section II: Mathematics (15 Questions)

Sequence and series, convergence of sequence of real numbers. Functions and their properties, limits, continuity and differentiability of functions, function optima, increasing and decreasing functions. Matrix algebra and its properties. Elementary set theory, vector spaces, subspaces, linear transformations, rank, nullity, eigen values, system of linear equations.

Section III: Statistics (35 Questions)

Types of data and their representations; measures of central tendency, dispersion, skewness, and kurtosis; Karl Pearson's and Spearman's correlations; partial and multiple correlations; and simple and multiple regression analysis, fitting of linear models.

Definition of probability; probability of events; addition rule; conditional probability; multiplication rule; independence of events; total probability; and Bayes' rule. Random variables and their types; probability distributions of random variables; cumulative distribution functions; distributions of functions of random variables; joint, marginal, and conditional distributions; mathematical expectation and moments; and moment generating and characteristic functions. Binomial, geometric, negative binomial, Poisson, hypergeometric, uniform, exponential, gamma, beta and normal probability distributions
Properties of a good estimator; Fisher–Neyman factorization theorem; minimum variance unbiased estimators (MVUE) and the Cramér–Rao inequality; complete statistics and the Rao-Blackwell and Lehmann-Scheffé theorems; and the methods of moments and maximum likelihood estimation.

Chebyshev's inequality and its applications; central limit theorem; and sampling distributions of the chi-square, t, and F statistics along with their properties.

Statistical hypotheses; Type I and Type II errors; critical regions; level of significance; size and power of a test; best critical regions; and most powerful tests.

Basic principles of experimental design. Analysis of variance (ANOVA). Basic designs: Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD).

Section IV: Operations Research (20 Questions)

Linear programming problem (LPP), graphical and simplex method, artificial variable method, concept of duality in LPP, dual simplex method. Transportation and assignment problems.

Section V: Data Science & Computing Basics (15 Questions)

Introduction to data science; data preprocessing and exploratory data analysis; basics of Python/R (syntax, data handling); introduction to machine learning concepts; supervised vs unsupervised learning.