Junior Research Fellowship for Research Course in Statistics (2026)

The candidates for research course in Statistics will have to take two short-answer type tests STA and STB. Each test is of two-hour duration. Test STA will have about 10 questions of equal value, set from selected topics in Mathematics and Statistics at the undergraduate level. Test STB will have roughly 8-10 questions of equal value, on topics in Statistics at Master's level.

Syllabus for STA Mathematics

Functions and relations. Matrices – determinants, eigenvalues and eigenvectors, solution of linear equations, and quadratic forms. Calculus and Analysis – sequences, series and their convergence and divergence; limits, continuity of functions of one or more variables, differentiation, applications, maxima and minima. Integration, definite integrals, areas using integrals, ordinary linear differential equations.

Statistics

(a) Probability: Basic concepts, elementary set theory and sample space, conditional probability and Bayes theorem. Standard univariate and multivariate distributions. Transformations of variables. Moment generating functions, probability generating functions, Markov and Chebyshev's inequalities, characteristic functions, convergence in probability, first and second Borel-Cantelli lemmas, almost sure convergence, weak and strong laws of large numbers, convergence in distribution and central limit theorem. Markov chains.

(b) Inference: Sufficiency, minimum variance unbiased estimation, Bayes estimates, maximum likelihood and other common methods of estimation. Optimum tests for simple and composite hypotheses, Likelihood ratio and large sample tests, p-value, Confidence intervals/sets, Elements of sequential analysis and non-parametric inference, Univariate nonparametric tests: sign, signed rank, Mann-Whitney, Kolmogorov-Smirnov and run tests.

(c) Multivariate Analysis: Standard sampling distributions. Basic properties of multivariate normal distribution, Wishart distribution, Hotelling's T2 and related tests. Analysis of discrete data – contingency, chi-square. Order statistics with applications, Principal component analysis, Basic ideas of classification and clustering: LDA and QDA, k-means and hierarchical clustering.

(d) Design of Experiments: Inference in linear models. One and two-way ANOVA. Standard orthogonal and nonorthogonal designs. Analysis of general block designs. Factorial experiments.

(e) Sample Surveys: Simple random sampling, Systematic sampling, PPS sampling, Stratified sampling. Ratio and regression methods of estimation. Non-sampling errors, Non-response bias.

(f) Correlation & Regression: Partial and multiple correlations. Linear regression analysis and logistic regression.