UNIVERSITY OF PUNE

Telephone Nos: 25696061/62,
Extn. 1358, 1359
Direct line: 25698752
Telegraphic Address:"UNIPUNA"
Fax: (020) 25693899

Department Of Statistics
And
Center For Advanced Studies
Ganeshkhind,
Pune - 411007 (India)

Department of Statistics
University of Pune
Ph.D. Entrance Test
Syllabus of Paper II

Analysis: Elementary set theory, finite, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum.
Sequences and series, convergence, limsup, liminf.
Bolzano Weierstrass theorem, Heine Borel theorem.
Continuity, uniform continuity, differentiability, mean value theorem.
Sequences and series of functions, uniform convergence.
Riemann sums and Riemann integral, Improper Integrals.
Monotonic functions, types of discontinuity, functions of bounded variation, Lebesgue measure, Lebesgue integral.
Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation.
Metric spaces, compactness, connectedness. Normed Linear Spaces. Spaces of Continuous functions as examples.

Linear Algebra: Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations.
Algebra of matrices, rank and determinant of matrices, linear equations.
Eigenvalues and eigenvectors, Cayley-Hamilton theorem.
Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis.
Quadratic forms, reduction and classification of quadratic forms.

Probability: Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate); expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Probability inequalities (Tchebyshef, Markov, Jensen). Modes of convergence, weak and strong laws of large numbers, Central Limit theorems (independent case).

Stochastic Processes: Markov chains with finite and countable state space, classification of states, limiting behaviour of n-step transition probabilities, stationary distribution. Poisson process, birth process, birth-death process

Proability Distributions: Standard discrete and continuous univariate distributions. Sampling distributions. Standard errors and asymptotic distributions, distribution of order statistics and range.

Statistical Inference: Methods of estimation. Properties of estimators. Confidence intervals. Tests of hypotheses: most powerful and uniformly most powerful tests, Large sample inference, Likelihood ratio tests. Analysis of discrete data and chi-square test of goodness of fit. Large sample tests.

Simple nonparametric tests for one and two sample problems, rank correlation and test for independence. Elementary Bayesian inference.

Linear Models\Regression: Gauss-Markov models, estimability of parameters, Best linear unbiased estimators, tests for linear hypotheses and confidence intervals. Analysis of variance and covariance. Fixed, random and mixed effects models. Simple and multiple linear regression. Elementary regression diagnostics. Logistic regression.

Multivariate Analysis: Multivariate normal distribution, Wishart distribution and their properties. Distribution of quadratic forms. Inference for parameters, partial and multiple correlation coefficients and related tests. Data reduction techniques: Principle component analysis, Discriminant analysis, Cluster analysis, Canonical correlation.

Sampling: Simple random sampling, stratified sampling and systematic sampling. Probability proportional to size sampling. Ratio and regression methods. Horwitz Thompson estimation.

Design of Experiments: Completely randomized, randomized blocks and Latin-square designs. Connected, complete and orthogonal block designs, BIBD. 2^K factorial experiments: confounding and construction.

Reliability: Series and parallel systems, hazard function and failure rates, censoring and life testing.

Linear Programming: Linear programming problem. Simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space, M/G/1.