INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
DEPARTMENT OF MATHEMATICS AND STATISTICS

Syllabus for PhD Admission
January 2026 Admission
Statistics

Interview: The interview will be mainly based on three areas chosen by the candidate, typically candidate's area(s) of interest.

Syllabus

1.1 Linear Algebra

System of Linear Equations, Matrices and Elementary Row Operations, Row-Reduced Echelon Matrices. Vector Spaces, Subspaces, Bases and Dimension, Ordered Basis and Coordinates. Linear Transformations, Rank-Nullity Theorem, The Algebra of Linear Transformations, Matrix Representation of Linear Transformations, Diagonalizability, Minimal Polynomial of a Linear Transformation, Cayley-Hamilton Theorem, Direct-Sum Decompositions, The Primary Decomposition Theorem, Inner Product Spaces, Orthonormal Basis, Gram-Schmidt Theorem.

1.2 Real Analysis

Real Number System and its Completeness, Sequences and Series of Real Numbers. Metric Spaces: Basic Concepts, Continuous Functions, Completeness, Intermediate Value Theorem, Compactness, Differentiation, Taylor's Theorem, Riemann Integral, Improper Integrals. Sequences and Series of Functions, Uniform Convergence, Power Series, Fourier Series, Weierstrass Approximation Theorem.

1.3 Probability Theory

Probability Measure, Probability Space, Limit of Events, Borel-Cantelli Lemma, Random Variables, Random Vectors. Distributions, Multi-dimensional Distributions, Independence, Expectation, Change of Variable Theorem, Moment Generating Function, and Characteristics Functions, Inversion and Uniqueness Theorems. Sequences of Random Variables, Modes of Convergence, Weak and Strong Laws of Large Numbers, Central Limit Theorem. Definition, Properties of Conditional Expectation, and Conditional Probability.

1.4 Statistics

Concept of Statistical Inference, Point Estimation, Methods of Estimations, Properties of Estimation, Uniformly Minimum Variance Unbiased Estimators (UMVUE), Rao-Cramer Lower Bound, Bhattacharya's Bound, Minimal Sufficiency, Rao-Blackwell Theorem, Lehmann-Scheffe Theorem, Order Statistics, Interval Estimation. Testing of Hypothesis, Type-I and II error, Power of the test, The Neyman-Pearson Fundamental Lemma, Uniformly Most Powerful Test, Unbiased Test, Invariance, Likelihood Ratio Test, Decision Theory, Bayes and Minimax Procedure, Minimum Risk Equivariant (MRE) Estimators.