

## ENTRANCE TESTS SYLLABUS FOR Ph.D. (Part A: Research Methodology-Mathematics and Statistics Both)

Note: The Ph.D. Entrance test for Ph.D. in Mathematics and Statistics consists of two parts:

- **Part A:** Research Methodology and
- **Part B:** Subject-Specific Knowledge.
- The Syllabus for Research Methodology is common to Mathematics and Statistics.

### UNIT-I

Origin of Research, objectives of research, motivation and necessity of research, Steps in Research, types of research, research approaches, significance and relevance of research, conditions for good research and criteria of good research, Action Research, Interdisciplinary, Multidisciplinary.

### UNIT-II

What is Research Problem?, selection of research problem for research, formulation of the selected research problems, choosing the research area, identification of research problem and solving research problems, pure and applied research, data collection, data analysis, conclusion. Documentation, report writing.

### UNIT-III


Literature review, review of published article and books in the field of research work undertaken, Importance of Literature review in defining a problem, including literature in research proposal, survey and peer review process, identifying gap areas from literature review; Major Research areas, Journals, Conferences and Status of Research in the field of Sciences.

### UNIT-IV

Philosophy and Ethics, Introduction to Philosophy: definition, nature, scope, concept, branches Ethics: definition, moral philosophy, nature of moral judgment and reactions. Scientific Conduct, Research ethics, research Intellectual honesty and research integrity. Copyright, scientific misconduct: falsification, fabrication, and Plagiarism.

### UNIT-V

What is Computer, Basic Applications of Computer; Components of Computer System, Central Processing Unit (CPU), Keyboard and Mouse, Other input/output Devices, Computer Memory, Concepts of Hardware and Software; Concept of Computing, Data and Information, Connecting keyboard, mouse, monitor and printer to CPU and checking power supply. Introduction of Internet, use of WWW, using search engines and advanced search tools, Email, MS-Word, MS-Excel, Power Point and online journals.

  
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# ENTRANCE TEST SYLLABUS FOR Ph.D. (STATISTICS)

## (Part B: Subject-Specific Knowledge)

Note: The Ph.D. Entrance test for Ph.D. in Statistics consists of two parts:

- Part A: Research Methodology and
- Part B: Subject-Specific Knowledge.
- The Syllabus for Research Methodology is common to Mathematics and Statistics.

### UNIT-I

**Probability Theory:** Classes of sets, field, sigma field, minimal sigma field, Borel field, sequence of sets, limits of a sequence of sets, measure, probability measure, Integration with respect to measure, Convergence in probability, almost sure convergence, convergence in distribution and their relationships, Chebyshev's inequality, weak law of large numbers, strong law of large numbers.

**Distribution Theory:** Discrete Probability Distributions: Bernoulli, Binomial, Poisson distribution, Hypergeometric, Geometric and Negative Binomial, and Multinomial distributions; Continuous probability distributions: Exponential, Gamma, Beta, Cauchy, Laplace, Pareto, Weibull, Normal and Log normal distributions.

### UNIT-II

**Demography:** Scope and application of demography, Dependence ratio, Basic Demographic equation; Measures of fertility: Crude birth rate, general fertility rate, age-specific birth rate, total fertility rate; Measurement of population growth: Gross reproduction rate and net reproduction rate, Theory of migration.

**Statistical Computing:** Tools for data analysis (numerical and visual summaries): descriptive statistics with graphics, Bivariate data : correlation and regression analysis, representation of multivariate data and its visualization, Eigen values and vectors, algebraic and geometric multiplicity of eigen values, vector and matrix differentiation, Inverse-transform method, generation of random samples from various univariate probability distributions in R.

### UNIT-III

**Inference:** Parametric models, Point estimation, Concept of mean squared error, Family of distributions admitting sufficient Statistic, Likelihood functions, Maximum likelihood method, Examples from standard discrete and continuous, Likelihood ratio test with its asymptotic distribution, UMP tests for monotone likelihood ratio family of distributions, Similar tests with Neyman structure.

**Sample Survey:** Sampling techniques, Allocation problem in Stratified sampling, Ratio method of estimation, optimum properties of ratio estimator, unbiased ratio type estimators, ratio method of estimation in stratified sampling, Regression method of estimation.

### UNIT-IV

**Multivariate Analysis:** Multivariate Normal Distribution and its properties, Marginal and Conditional Distributions, Moment Generating and Characteristics functions, Sample from multivariate normal distribution, unbiased estimators of Mean vector and Dispersion matrix.

**Regression Analysis:** Gauss-Markov set-up, Normal equations and Least squares estimates, Error and estimation spaces, variances and covariances of least squares estimates, estimation of error variance, estimation with correlated observations, Least squares estimates with restriction on parameters.

### UNIT-V

**Bayesian Inference:** Natural Conjugate family of priors for a model, Bayesian point estimation, Bayesian interval estimation, Bayesian testing of Hypothesis, Bayesian prediction problem.

**Computer-Intensive Statistical Methods:** Stochastic simulation, Simulation from multivariate normal distribution, Monte Carlo methods in inference, Probability density estimation, Markov Chain Monte Carlo methods.

**Operations Research:** Inventory Control, Sequencing Problems, Network drawing and analysis, PERT and CPM, Non-Linear Programming.



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