Department of Statistics

Syllabus for Ph.D. Entrance Test (PET)

The syllabus for PET Examination is based on M.Sc. (Statistics) syllabus semester I to IV. The research component is also included.

A. Research Methodology:

Unit 1:

Meaning of research, Objectives of research, types of research, Significance of Research, Research approaches, Research methods versus Methodology, Research and Scientific methods, Research process, Criteria for good research

Defining the research Problem: What is a research problem, Selecting the problem, necessity of the defining the problem, techniques involved in defining a problem

Unit 2:

Measurements and Scaling Techniques: Quantitative and Qualitative data, Classification of measurement scales, Goodness of measurement scales, Sources of error in measurement, Techniques of developing measurement tools, Scale classification bases, Scaling techniques, Types of scales – ordinal, nominal, ratio, interval. Multidimensional techniques and deciding the scales, types of variables

Unit 3:

Designs of sample surveys: sample design, sampling and non sampling errors, sample survey verses census survey, types of sampling designs, non probability sampling, probability sampling, complex random sampling designs.

Unit 4:

Research design: Meaning, need and features of research design, Important component related to research design, research design for exploratory research studies, Descriptive and diagnostic research studies, hypothesis testing research studies.

Experimental designs: Before and after without control design, After–only with control design, Before and after with control design, Different research designs.

Unit 5:

Paper writing and Report Generation **:**Basic concept of research paper/thesis writing and report generation, writing research abstract, introduction, Review of literature, results/conclusion, concept of Bibliography and References, Significance of report writing, steps of report writing, types of research reports, methods of presentation of report, formats of publication in research journal.

B. Subject Specific:

Unit 1:

Probability Theory: Fields and sigma fields, Distribution Functions, independence, expectation and moments, Convergence of Sequence of Random variables, Characteristic function, Law of Large Numbers, central limit theorem and its application.

Probability Distributions: Discrete and continuous probability Distributions and their properties. Sampling distributions, Order statistics

Stochastic processes: Markov Chain, Poisson process, Branching process, Auto correlation, Brownian Motion Process (BMP Wiener Process).

Unit 2:

Sampling Techniques: SRSWR, SRSWOR, Stratified sampling, Systematic sampling, PPS, Cluster, Two stage, Multistage sampling, Double Sampling.

Estimators: Ratio and Regression estimators, Horvitz and Thomson estimator, Desraj Murthy estimators.

Linear model and Design of experiments: Theory of estimation, Estmability of linear parameters, One way ANOVA , Two way ANOVA, CRD, RBD, LSD, analysis of co-variance, Factorial Experiments, Confounding, spilt plot design, strip plot design, BIBD, PBIBD.

Unit 3:

Statistical Inference: Point Estimation, Characteristics of good estimators, Concept of completeness and sufficiency, MVUE, MLE and method of moments, testing of hypothesis, Interval estimation, Non-parametric tests.

Consistent estimators, CAN estimators, one and multi parameter exponential family of distributions, Cramer's family of distributions, Likelihood ratio Test (LRT), Large sample tests, variance stabilizing transformations.

Unit 4:

Quadratic forms, Characteristic roots and vectors, Generalized inverse, Moore – penrose generalized inverse and all basic properties. Hermitian matrices and its properties.

Regression Analysis: Correlation, Linear and non-linear Regression analysis, Robust and L-I Regression, Generalized linear Model, Multicollinearity, Ridge regression.

Multivariate Analysis : Multivariate Normal Distribution, Quadratic forms and their distributions, applications of Hotelling's T^2 statistic, Properties of Wishart Distribution, MANOVA, Principal component analysis, Classification and discriminant analysis, Cluster analysis, Factor analysis.

Unit 5:

Operations Research: L.P.P., Transportation & Assignment problem, Non- linear programming problem, quadratic programming problem, inventory management, sequencing and scheduling, Game theory, Replacement models, PERT& CPM, Queuing models.

Industrial Statistics: Quality System, Control charts for attribute and variables, Moving average and exponentially weighted moving average (EWMA) charts. Cusum charts, Acceptance sampling plans for attribute and variables, methods of forecasting, Reliability Theory, Coherent System, Minimal path and cut sets.