PAPER: STATISTICS (100 MARKS)

Part – I (50 marks)

I. **Descriptive Statistics**

Definition, Importance and scope of Statistics, Descriptive and Inferential Statistics, Presentation of the Data, Tables, Graphs and Charts: Stem-and leaf diagram, Box and Whisker Plots. Measures of Central Tendency/location, Measures of Dispersion/Variability: Measures of Skewness and Kurtosis.

II. **Basic Probability**

Basic Probability Concepts, Additive and Multiplicative laws of Probability, Joint and Marginal Probabilities, Conditional Probability and Statistical Independence, Bayes' rule. Concept of a Random Variable, Mathematical Expectations, Discrete and Continuous Random Variables, Probability Distribution, Mean and Variance of a discrete random variables.

III. **Probability Distributions**

Discrete and continuous Probability Distributions.Properties, applications of Binomial, Poisson, Hyper-geometric, Normal Distribution and its properties, Standard Normal Curve, Normal approximation to Binomial and Poisson distribution.

IV. **Regression Analysis & Correlation Analysis**

Concepts of Regression and Correlation and their application, Simple and Multiple Linear Regression (upto three variables), Estimation of the Parameters, Method of least square, Inference regarding regression parameters

Correlation, Correlation Coefficient, Properties of Correlation Coefficient, Inference regarding correlation coefficient, Partial Correlation and Multiple Correlation (upto three variables).

V. **Non-Parametric Methods**

Parametric versus nonparametric tests, when to use non-parametric procedures, One-sample tests: Sign test, Wilcoxan signed ranks tests, Kolmogrov-Smirnov test, run test.

Tests for two related samples: sign test, run tests, chi-square test, Test for two independent samples: Mann-Whitney test, Kolmogrov-Smirnov test.

Part – II (50 marks)

I. **Sampling & Sampling Distributions**

Population and Sample, Advantages of Sampling, Sampling Design, Probability &Non-Probability Sampling techniques.Brief Concepts of Simple Random, Stratified, Systematic, Cluster, Multiple and Multistage Sampling. Purposive, Quota Sampling, Convenience & Accidental Sampling.

Sampling with and without replacement, Application of Central Limit Theorem in Sampling, Sampling Distribution of Mean, difference between two Means, Proportion, difference between two Proportion and Variance.

II. **Statistical Inferences**

Estimation: Point Estimation, Properties of a good Estimator.Interval Estimation. Interval Estimation of Population mean. Large and small sample confidence intervals for Population Mean.

Hypothesis Testing: Types of errors. Hypothesis Testing for Population Mean. Inferences for Two Population Means. Inferences for the Mean of Two Normal Populations using Independent Samples (variances are assumed Equal). Inference for Two Populations Mean using Paired Samples.Inferences for Population Proportions. Confidence Intervals and hypothesis testing for Population Proportion. Inferences for Two Populations Proportions using Independent Samples, Estimation of sample size

Analysis of categorized data.Goodness of fit tests.Contingency tables. Test of independence in contingency tables.

III. **Design of Experiments**

One-way and Two-way Analysis of Variance, Design of Experiments, Concepts of Treatment, Replication, Blocking, Experimental Units and Experimental Error, Basic Principles of Design of Experiments, Description, Layout and Statistical Analysis of Completely Randomized Design (CRD), Randomized Complete Block Design (RCBD), Multiple Comparison tests (LSD test).

IV. **Population Analysis & Vital Statistics**

Population and Demographic Methods, Sources of Demographic data, Basic Demographic Measures, Sex Ratio, Child Women Ratio, Vital Index, Crude and Specific Birth and Death Rates, Total Fertility and Net Reproduction Rates.

Official Statistics: Statistical Systems in Pakistan, Functions of Statistics Division and Bureaus of Statistics: The National Income, Gross Domestic Product, Saving and Wealth, Index Numbers.

SUGGESTED READINGS

Sr. No.	Title	Author
1.	Principles and Procedures of Statistics	Steel, R and Torrie, J.H.
2.	Biostatistical Analysis	Zar, J.H.
3.	Probability and Statistics for Engineers and Scientist	Walpole, R.E., Myers, R.H. and Myers, S.L.
4.	Introduction to Statistical Theory, Part-I & II	Chaudhry, S.M. and Kamal, S.
5.	Introduction to Probability Theory and Statistical Inference, 3rd Edition.	Larson, H.J.
6.	Design and Analysis of Experiments	Montgomery, D.C.
7.	Fundamentals of Modern Statistical Methods	Wilcox, R.
8.	Latest Statistical Methods	Vaidyanathan, M.
9.	Statistical Methods	Aggarwal, Y.P.
10.	Mathematical Statistics	Freund, John E.
11.	Demographic Methods	Andrew Hinde
12.	Publications of Federal Board of Statistics and Provincial Board of Statistics. Pakistan.	Govt. of Pakistan