Major + Minor Courses of Statistics

Stat-700 Elements of Statistics and Biometry 3(3-0)

Definition and scope of statistics in research, Measurement scales, Type of variables, continuous and discrete data. Grouping of data. Presentation of data, one dimensional diagrams and graphic presentation of frequency distribution, stem-leaf and box plots. Measures of central tendency and their graphic location. Measures of dispersion, Tchebychev law, sampling and sampling distribution of single population mean. Tests of significance for single population mean and proportion, difference between means and proportions and their confidence intervals. One and two way Analysis of variance calculations only.

Books recommended:

Stat-701 Experimental Statistics 3(3-0)

Functional relation among variables, regression analysis, simple and multiple linear regression analysis, curve fitting, correlation analysis; simple partial and multiple correlation, estimation & testing of hypotheses, tests of independence and goodness of fit, analysis of variance, basic designs, basic principles of experiment design, post hoc tests. Some designs of experiment with illustrations of problems from various agricultural disciplines, factorial, split plot, split block experiments, Hierarchical analysis with 2 &3 factors.

Books recommended:

Stat-702 Statistical Methods for Business Management (3(2-1)

Theory:
Introduction to business research, business research process, Errors in business research. Types of research and research Designs. Type of variables and measurement scales, Measurement scale of attitude, Data collection instruments, Questionnaire designs. Concept of validity and reliability. Concept of sampling and sampling designs, Estimation of mean, variance and proportion under different probability sampling designs. Estimation of mean, variance and proportion under different probability sampling designs Estimation and interpretation of simple linear Regression Inference in sample linear Regression Estimation
and interpretation of Multiple linear Regression Standardized regression Coefficients, Inference in Multiple Linear Regression, Chi-square test of independence, measures of associations, Linear Correlation, Inference in Simple Linear Correlation, Principal component analysis, Cluster Analysis.

Practical:
Introduction to Minitab, data manipulation in Minitab, Programming in Minitab, Construction in Minitab, Programming in Minitab, Construction of Macros in Minitab. Introduction to SPSS, data manipulation in SPSS.

Books Recommended:

**Stat-703 Design and Analysis of Experiments for Researchers 3(3-0)**

Factorial experiments, main effects and interactions analysis of variance model, fixed, random and mixed models, treatment structure, contrasts, orthogonal contrasts and polynomials for quantitative treatment factors, single replicated trials, split plot design and its variants, hierarchical classification, combining experiments over locations, seasons and years, confounding in $2^n$ and $3^n$ factorial experiments and their analysis. Fractional factorials, cross over designs, response surface designs for optimal response.

Books Recommended:


**Stat-704 Statistical Methods for Social Sciences 3(3-0)**

Sampling and sampling designs, selection of best sample design, procedure for planning and conduct of census and surveys, determination of sample size under different conditions, Test of significance for population proportion, multifactor analysis of variance, multiple comparisons, non-parametric methods (Sign test, Signed rank test, Mann-Whitney U test, Kruskal-Wallis test, Friendman test, Spearman’s and Kendall’s rank Correlation;, Non-parametric multiple comparisons, Multi-way contingency tables, log linear models logistic Regression.
Stat-705   Statistical Methods  3(3-0)
Statistics and Scientific methods Inference about the parameters of Binomial, Poisson and Normal distributions, Estimation of sample size, chi-Square procedure, chi-Square goodness-of-fit test, Non-parametric and distribution free methods, probability plots, Box-Cox and Box-Tidwell transformations, Correlation and regression analysis, Test of significance of simple, multiple and partial correlation coefficients, Inference regarding regression parameters, relative importance of regression, linear and non-linear regression prediction, adequacy of regression models.
Books Recommended:

Stat-706   Probability and Distributions Theory-I   3(3-0)

RECOMMENDED BOOKS:

Stat-707 Probability and Distribution Theory-II  3(3-0)
Transformation, of n dimensional random variables for discrete and continuous case, Moment generating function of discrete and continuous Bivariate probability distributions, truncated distribution Compound distribution and their mean and variance cumulative distribution function, generating functions and their related properties, Conditional expectation, Conditional variance and their properties, Regression curves on different bivariate probability Convolutions, Characteristic function of distributions its application and related properties, Limit theorems and its application [Chebyshev,s inequality, Bienayme inequality, convergence in probability, weak law of large numbers, Bernoulli,s law of large numbers, central limit theorem, Lindberg- Levy theorem, derived distributions X^2, t, F, and z and its related properties & non central derived distributions X^2, t F, and z. Order statistics with application in different field, Introduction to stochastic process.

Books recommended

Stat-708 Estimation and Testing of Hypotheses 3(3-0)
Books Recommended:


**Stat-709 Theory & Application of Linear Models 3(3-0)**

Basic theory illustrated in terms of various type of regression and classification models: Estimability, Estimation and prediction pivotal function, Hypothesis testing confidence intervals, Restricted models, Extension to correlated observations Reparametrization, 2-part G.M. Model and analysis of covariance, K-part G.M. model, Extensions to mixed and random linear models, inference for variance components, BLUP.

Books Recommended:


**Stat-710 Sample Surveys-I 3(3-0)**

Introduction of sampling theory, its advantages and applications, probability and non-probability sampling. Methods of collecting information, Bias and its effects. Simple random sampling. Estimation of Mean, Total and their properties, proportions and ratio Uses of normal, binomial and hyper-geometric distribution in sample survey. Extimation of sample size under different situations. Stratified random sampling. Proportional and optimum allocations Estimation of mean and variance and their properties, relative precisions of estimates Estimation of sample size with stratified random sampling for continuous and discrete data.

Books Recommended:


**Stat-711 Sample surveys-II 3(3-0)**
Ratio, Regression and Product Estimates in simple and stratified random sampling. Estimate of Mean and Variances with their properties. Systematic sampling Estimation of mean and variances and their properties. Single and tow stage cluster sampling with equal and unequal sizes. Estimation of mean and variances with their properties Double sampling: Estimation of Mean Variance with their properties.

Books Recommended:

Stat-712 Experimental Design-I 3(3-0)

Introduction to Experimental Design; Experimental design, Planning of experiment and research; Experimental design and its terminology, Basic principles of DOE, Basic designs; layout, models, expected mean squares, estimation of parameters, matrix and non-matrix approaches, Inference about means after ANOVA, Multiple comparison tests: LSD test, Duncan’s test, Tuckey’s test, Scheffe’s test Orthogonal contrast test, Dunnet’s test, bonferroni; Analysis of variance in regression, Polynomials, Orthogonal Polynomials, Fixed, Random and Mixed effect Models, Variance components, Model adequacy checking, transformation, Distributional and Properties of least squares estimates of model parameters; Sub-sampling in basic designs, Analysis of covariance with one, two or more concomitant variable(s), Distribution of different sum of squares, Comparison between ANOVA & ANOCOVA; Concept of missing data and its estimation, Graeco-Latin Square Design; Relative efficiency of these designs.

Books Recommended:

Stat-713 Experimental Design-II 3(3-0)

Factorial experiments; Simple, Main and Interaction effects, hidden replication, $2^k$ and $3^k$ series and mixed level factorial experiments and their analysis. Confounding in factorial experiments, Complete and partial confounding; fractional factorials, confounding in fractional replications, Quasi Latin Square designs, split plot, split block, split-split plot, strip plot and nested designs, missing observations in split plot design, Incomplete block designs: BIBD-Lattice, lattice square and Youden squares, PBIBD with recovery of intra-block information.
Introduction of response surface methods; First and second order designs, central composite designs, fitting of response surface models and estimation of optimum/maximum response.

Books Recommended:


Stat-714 Econometrics-I 3(3-0)

Books Recommended:

Stat-715 Econometrics-II 3(3-0)
Detection, Sources and consequences of Autocorrelation and Heteroscedasticity, Generalized least square. Error in Variables; tests, consequences and its remedies for measurements errors in dependent and independent variables. Stochastic Regressors; properties of estimators of regression models when random regressors are correlated with disturbance term and its tests for detection of correlation between random regressors and disturbance term. Simultaneous equation system; Structural and reduced form equations. Single equation techniques; Indirect least square, two stage least square, Instrumental variable estimator, limited information maximum likelihood estimator, System equation techniques; three stage least square. Identification by rank and order condition.
Books Recommended:

Stat-716 Multivariate Statistical Methods 3(3-0)

Books Recommended:

Stat-717 General Statistical concepts 3(3-0)
Introduction to demography; age and sex composition, fertility, morality and life tables, migration, migration and divorce, introduction to psychometry; reliability and validity, essential preparation for verbal numerical and spatial aptitude tests and personality tests (testing series). Official statistics; Organizing and conduction of population and agricultural livestock and industrial censuses in Pakistan, Intr-censual surveys conducted by Federal Bureau of Statistics and its provincial counterparts, Sample designs and Questionaires of these surveys.

Books Recommended:

Stat-718 Statistical Quality Control 3(3-0)
Principles of Quality Control, Statistical Quality Control, Total Quality Control, Quality Assurance, Methods and philosophy of statistical process control Shewhart control charts for variables and attributes
causes for quality variation, Uses of control charts, Statistical basis for control charts, Operating characteristic function and ALR, Statistical process control for short production runs, Acceptance and modified control charts, Multivariate quality control problems, Process capability analysis, Cusum control charts for sample average, Exponentially weighted moving average control charts, Acceptance sampling plans, Types of sampling plans, Rectifying inspection, Operating characteristic curve for sampling plans, Military standard 105E, ISO series.

Books Recommended:

Stat-719 Special Problem 1(1-0)
Stat-720 Seminar 1(1-0)

Stat-721 Advanced Design of Experiments 3(3-0)
Incomplete block designs, two dimensional lattices, rectangular lattices balanced incomplete and parital balanced incomplete block designs, generalized lattice designs, alpha designs, Design resolution. Fractional replication, blocking in fractional replication, First and second order response surface designs, Taguchi methods, Quasi, magic and super magic latin squares and weighting designs. Latin square type crossover designs. Optimal designs (A optimal, D Optimal).

Books Recommended:

Stat-722 Multivariate Statistical Inference 3(3-0)
Multivariate normal distribution, testing of hypothesis about equality of mean vectors and covariance matrices, Generalized T2 statistic, Multivariate Behrens-Fisher problem, principle components, factor analysis, canonical correlation, discriminant analysis, cluster analysis, CART, multivariate regression analysis MANOVA.

Books Recommended:
Stat-723 Survey / Research Report 4(0-4)

Stat-724 Statistical Models 3(3-0)
Introduction to Statistical Models, Measurement phenomena, Errors, Statistical approach, Processing of data, probability, Random events, Nature of statistical model, Random variables and statistical models; Procedures to construction of statistical models, Life time models, General formulation, Survival function, survival rate, Lifetime distribution function and event density, Hazard function and cumulative hazard function, Quantities derived from the survival distribution, Censoring, Truncation and truncated models, Parametric and Non-parametric estimation, Distributions used in survival analysis, The Normal Model and its properties, two and three parameters case with applications. The Gamma Models and their properties, Two and three parameter case, Special case(Chi square and Erlang Models), Special case (Exponential Model) and their applications, The Beta Model and its properties, Two and three parameters case, special case (Uniform Model), Relationship to Other Distributions (Like F-distribution, t-distribution, Gamma Distribution, Normal Approximation, Poisson and Chi square approximations), The Type-I Extreme Value Model, Development of the Model, Types of Extreme Value Asymptote, The Characteristic Largest Value, The Type-I Asymptote of Maxima, Properties of the Model, Connections with Initial Distributions, The Weibull Model and Related Cases, Properties of the Model. Two and three parameters case; Special case (Exponential and Rayleigh Models). Connections with Initial Distribution, The Log-Normal and Gamma Cases.

Books Recommended:

Stat-725 Analysis of Categorical Data 3(3-0)
Problems and examples of categorical data, Multinomial distribution and confidence intervals for log contrasts of parameters. Pearson’s $X^2$ and 2 log-likelihood ratio test for multinomial alternatives. Multi-way tables and cross product ratio as a measure of association. Ordinal probabilities, Scores and odds ratio, relative risk, Log linear models for two way table (comparison to ANOVA) and extension to three way table, hierarchical models, MLE of parameters and interpretation of hypothesis, Asymptotic distribution of log contrasts. Logistic regression dichotomous response.

Books Recommended:

Stat-726 Analysis of Time Series Data 3(2-1)

Theory:
Importance of Time Series; Time series models and their types, univariate time series models, Multivariate time series models, Components of time series models, Stationary, Non-Stationary, Autoregressive Models, Moving Average Models, Autoregressive Moving Average Models, Autoregressive Integrated Moving Average Model, Partial Autocorrelation Box-Jenkins Approach, Box-Jenkins Model Identification, Box Jenkins Model Estimation; Correlatogram and periodogram, Forecasting and spectral analysis (Eviews 6, SPSS, MiniTab) for problem solving using time series data published by Government departments of Pakistan.

Books Recommended:

Stat-727 Advanced Probability Theory 3(3-0)
Introduction to probability measure theory; its terminology, Set theory, Counting techniques, Boral sets, Fields, Sigma fields and measure, construction of sigma field, Riemann integral, probability measure, extension of measures, constriction of extension, Monotone classes, uniqueness, completeness, inversion, Lebesque measures on the unit interval, Lebesque-stieltjes measures and distribution functions, Functions, measurable functions, Convex function, Probability spaces, event, independence, The Borel-Cantelli Lemmas, product spaces and Fubini’s theorem, Inequalities and limiting operations; markove’s, Jensen’s, AM-GM’s, Schwarz’s, Minkowski’s Holder’s, and Young’s inequalities. Limit theorems, convergence of distribution, convergence of sequences of measureable functions, weak convergence of measures, Martigale theory, Probability models and simulation.

Books Recommended:

Stat-728 Statistical Data Analysis 3(0-3)
Use of statistical packages like MSTATC, SPSS, SAS Lindo Minitba etc. to solve the practical problems in Design of experiment, Regression, Econometrics etc. (At least two packages shall be covered in this course) programming with R-Language.

Books Recommended:
Basic set theory: sets, subsets, power set, algebra of sets, Venn diagram, intervals and related word problems; Sequence and series; A.P., G. P., H. P., nth term, sum of 1st n terms, means and applications. Binomial theorem, binomial series and its simple application. Matrices; algebra of matrices, determinants, inverse of a matrix; trigonometry: trigonometric identities, inverse trigonometric functions, finding heights, distances and widths using trigonometry and area of a triangle. Calculus and Analytic Geometry: division of a line segment, equation of a straight line and other standard curves, relations and functions, limit, continuity, differentiation, differentials; anti-derivation by standard results by substitution and by parts.

Books recommended: