

**DEPARTMENT OF STATISTICS
SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



SYLLABUS EFFECTIVE FROM: 2017-18

**MASTER OF SCIENCE (APPLIED STATISTICS)
Course Syllabus and Structure of for M.Sc. (Applied Statistics)
Semester – II**

PS02CAST21 : PARAMETRIC INFERENCE AND NONPARAMETRIC INFERENCE

<u>Unit 1</u>	Point Estimation: unbiased, consistency, efficiency and sufficiency, minimal sufficiency, completeness.(discussion of methods without proofs.) Examples related to well known discrete and continuous distributions. Information function and Information matrix(Computation for well known distributions). C-R Lower bound;regularity conditions, Uniformly Minimum Variance Unbiased estimation; Least square estimator, Moment Estimators, Maximum Likelihood Estimators	12L
<u>Unit 2</u>	Basic Concepts of testing of hypothesis; Most powerful tests- Neymann-Pearson Lemma and its applications, Uniformly most powerful tests, Uniformly Most Powerful Unbiased Tests. Invariant tests, Maximum Likelihood Tests, Sequential Probability Ratio Tests.	12L
<u>Unit 3</u>	Tests of Randomness,Goodness of fit tests-Chisquare and K-S test, Sign Test, Signed Rank Test, Wicoxon Rank Sum Test, Wilcoxon-Mann-Whitney Test, Paired Rank Test, Normal Score Tests, Mood's Test, Locally Most Powerful Rank Tests.	12L
<u>Unit 4</u>	Several Sample Tests: Kruskal-Wallis Test,. Distribution-Free Test for Ordered Alternatives (Jonckheere, Terpstra),Distribution-Free Tests for Umbrella Alternatives (Mack-Wolfe), A Distribution-Free Test for General Alternatives in a Randomized Complete Block Design (Friedman, Kendall-Babington Smith), A Distribution-Free Test for General Alternatives in a Randomized Balanced Incomplete Block Design (BIBD) (Durbin, Skillings-Mack)	12L

Recommended Book

- 1 Rohatgi V. K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2ndEdn(Reprint) John Wiley and Sons.
- 2 Dudewicz, E. J., and Mishra, S. N. (1988): Modern Mathematical Statistics. John Wiley & Sons.
3. Manoj Kumar Srivastava and Namita Srivastava(2009). Statistical Inference: Testing of Hypotheses, Prentice Hall India
- 4 Jean Dickinson Gibbons and Subhabrata Chakraborti(2010)Nonparametric Statistical Inference, Fifth Edition, Chapman and Hall/CRC

PS02CAST22: LINEAR MODELS AND REGRESSION ANALYSIS

- UNIT 1 Introduction of models based on nature of data; preliminary of matrix algebra; need of estimation of linear parametric functions; Gauss-Markov set-up, Normal Equations and Least Square Estimates, Error and estimation spaces, variances and covariance of least square estimates, estimation of error variance, distribution of sum of square due to regressors, errors estimation with correlated observations, least square with correlated observations, least square estimates with (a) restriction on parameters (b) specification error, simultaneous estimates of linear parametric functions. 12L
- UNIT 2 Tests of hypotheses for one and more than one linear parametric functions, confidence intervals and regions, Analysis of Variance, Power of F-test, Multiple comparison tests due to Tukey and Scheffe, simultaneous estimates of linear parametric functions. 12L
- UNIT 3 Introduction to one-way random effects linear models and estimation variance components. 12L
Simple linear Regression, multiple regression, fit of polynomials and use of orthogonal polynomials.
- UNIT 4 Residual and their plots as test for departure from assumptions such as fitness of the model, normality, homogeneity of variances and detection of outliers, Remedies. 12L
Multicollinearity, Ridge regression and principle component regression, subset selection of explanatory variables, Mallor's C_p Statistic.
Introduction to non-linear models.

Books Recommended:

1. Weisberg, S.(2005). Residual and Influence in Regression. Wiley Series in Probability and Statistics, Wiley
2. Draper, N.R. and Smith, H.(1998).Applied Regression Analysis. Third Edition, Wiley India Ltd.
3. Gunst,R.F. and Mason, R.L.(1980). Regression Analysis and its Applications –A Data Oriented Approach. Macel and Dekker.
4. Rao, C.R. (2001) Linear Statistical Inference and its Applications. Ed. II, Wiley Eastern.
5. Weisberg's.(1985). Applied Linear Regression. Wiley Series in Probability and Statistics, Wiley
6. Gujarathi, D.N. and Sangeetha (2007). Basic Econometrics, Ed. IV , Tata MacGraw Hill
7. Montgomery, D.C., Peck, E.A and Vinning, G.G. (2010). Introduction to Linear Regression Analysis, Ed.III, Wiley
8. Freund, J. R, Wilson, W.J, and Sa, P. (2006). Regression Analysis: Statistical Modeling of Response Variable, Ed.II, Academic Press
9. Kshirsagar, A.(1983). A Course in Linear Models, Statistics : Textbook and Monographs, Vol. 45, Marcel Dekker, Inc.
10. Hey-Jahans, C.(2012) .An R Companion to Linear Statistical Models ,CRC Press

PS02CAST23: STATISTICAL QUALITY CONTROL AND RELIABILITY

- Unit-I The meaning of quality and quality improvement, dimensions of quality, Quality engineering terminology, A brief history of quality methodology, The link between quality and productivity, quality costs, Legal aspects of quality. [12]
Brief discussion on Seven QC tools.
- Unit-II Statistical Basis of Control Charts: Basic Principles, Choice of Control limits, [12]
Sample size sampling frequency, rational subgroups, analysis of pattern on control charts, discussion on sensitizing rules for control charts.
Control Charts for Variable: \bar{X} and R chart, and \bar{X} and R chart. The S^2 control chart: OC function, ARL_0 and ARL_1 , Average time to signal(ATS), Expected number of individuals sampled(I). Control charts for individual measurements
Control Charts for Attributes: p, np, c and u charts.
- Unit-III Acceptance Sampling plans: Single, double & multiple sampling plans for [12]
attribute. Curtailed double sampling plans. Operating characteristic functions & other properties of the sampling plan. Use of sampling plans for rectification. Designing sampling plans. Dodge-Romig acceptance sampling plans. Acceptance sampling plan for variables with single & double specification limits. Designing variable acceptance sampling plans. AQL based sampling plans. Continuous sampling plans CSP-I & CSP – II.
- Unit-IV Elements of Reliability: Binary coherent structure, min path/cut sets/paths, [12]
lower/upper bounds for reliability functions, k-out-of-n:G, bridge structures. Reliability availability of one unit system supported by one repair facility and one standby.
Hazard Rate/Failure Rate, Cumulative Hazard Rate Reliability Function. Properties of Hazard Rate. Classification of life distribution with respect to failure rate, failure rate average. Exponential, Gamma and Weibull life distributions.

References

- Montgomery, D. C. (1985) Introduction to Statistical Quality Control.(Wiley)
Barlow R. E. & Proschan F. (1975) Statistical Theory of Reliability & Life testing. Holt, Rinehart & Winston Ins.

PS02CAST24: STATISTICAL METHODS THROUGH SPSS

Unit-I	<p>Introduction: Samples and the Population, Level of Measurement A Special Case: Rating Scales ,Independent and Dependent Variables, Data Access.</p> <p>Data Checking :Viewing a Few Cases ,Minimum, Maximum and Number of Valid Cases ,Identifying Inconsistent Responses ,When Errors are Discovered,SPSS Missing Values Option</p> <p>Describing Categorical Data :Frequency Tables and Bar Charts, Standardizing the Chart Axis, Pie Charts</p> <p>Comparing Groups(Categorical Data)A Basic Two-Way Table ,Chi-Square Test of Independence ,Requesting the Chi-Square Test ,Different Tests, Different Results? Association Measures Available within Crosstabs ,Graphing Cross Tabulation Results, Three-Way Tables ,Extensions</p>	12L
Unit-II	<p>Exploratory Data Analysis: Interval Scale Data: Frequency Tables and Histograms, Exploratory Data Analysis, Options with Missing Values, Measures of Central Tendency ,Variability Measures, Confidence Band for Mean ,Shape of the Distribution ,Stem & Leaf Plot ,Box & Whisker Plot, Saving an Updated Copy of the Data</p> <p>Mean Differences Between Groups I: (Simple Case)Logic of Testing for Mean Differences, Sample Size, Exploring the Different Groups, T- Test, Displaying Mean Differences, Paired T Test , Normal Probability Plots</p>	12L
Unit-III	<p>Mean Differences Between Groups II:(One Factor ANOVA)Logic of Testing for Mean Differences ,Factors ,Exploring the Data, Running One-Factor ANOVA, One-Factor ANOVA Results, Post Hoc Testing of Means ,Graphing the Results,</p> <p>Mean Differences Between Groups III: (Two Factor ANOVA): Logic of Testing and Assumptions, How Many Factors? Interactions, Exploring the Data, Two-Factor ANOVA, The ANOVA Table, Observed Means, Presenting the Results</p>	12L
Unit-IV	<p>Bivariate Plots and Statistics: Reading the Data, Exploring the Data, Scatterplots, Correlations</p> <p>Introduction to Regression : Introduction and Basic Concepts, The Regression Equation and Fit Measure, Residuals and Outliers, Assumptions, Simple Regression, Multiple Regression ,Residual Plots ,Multiple Regression Results, Residual and Outlier Results ,Summary of Regression Results ,Stepwise Regression, Stepwise Regression Results, Stepwise Summary.</p>	12L

References

- [Eelko Huizingh](#) (2007) Applied Statistics with SPSS, SAGE
- [Robert H. Carver](#) and [Jane Gradwohl Nash](#)(2011) Doing Data Analysis with SPSS, Cengage Learning.
- [Colin D. Gray](#), [Paul R. Kinnear](#)(2011) IBM SPSS Statistics 19 Made Simple, Taylor & Fransis.
- [Andy Field](#)(2000).Discovering Statistics Using SPSS for Windows: Advanced Techniques for Beginners, SAGE
- [John Hedderson](#) and [Melinda Fisher](#)(1993). SPSS Made Simple, Wadsworth Publishing Company.
- [Elliot T. Berkman](#) and [Steven P. Reise](#) (2011). A Conceptual Guide to Statistics Using

SPSS, SAGE

[Richard Burns](#) and [Robert P Burns](#) (2008). Business Research Methods and Statistics
Using SPSS, SAGE

PS02EAST21: LEAN SIX SIGMA METHODOLOGY

Unit-1	Overview of Lean and Six Sigma with principles. Methodologies – Introduction to SCORE, DMAIC, DMADV. The nine Wastes in the process Industries, Voice of the customer, SIPOC. Value- Importance, value-adding and non-value-adding activities. Value Stream Mapping(VSM): Objective, Concept of flow- lead time, takt time, cycle time, throughput time, generating the map, Analyzing the current state map. Generating Potential Solutions for the Future State- Brainwriting, Escapism, Random Stimulus, Analogies, SCAMPER. Future state VSM.	12L
Unit-2	Total Productive Maintenance- availability, performance and quality, Overall Equipment Effectiveness (OEE) and Uptime. Single Minute Exchange of Dies (SMED), Visual Management- Importance, visual work area, visual displays and scheduling. Kaizen, Pull-Push systems and perfection. Bottleneck-Finding, managing and improving it. Poka-Yoke, tools used to get to root cause, Kanban, finished goods, buffer and safety stocks calculations. Resource Reliability Enhancement.	12L
Unit-3	Six Sigma Roles and Responsibilities. Tools used in Define Phase. Tools used in Measure Phase. Spaghetti diagram.	12L
Unit-4	Tools used in Analyze Phase. Various Statistical Techniques used in analyze Phase (Revision), Tools used in Improve/Design Phase. Tools used in Control/Verify Phase.	12L

References

- 1 Peter L. King (2009) Lean for the Process Industries, Dealing with Complexity, First Ed. (CRC Press).
- 2 Lonnie Wilson (2010) How to Implement Lean Manufacturing, First Ed. (McGraw Hill).
- 3 Issa Bass and Barbara Lawton (2010) Lean Six Sigma using SigmaXL and Minitab, First Ed.(McGraw Hill).
- 4 R. A. Munro, M. J. Maio, M. B. Nawaz, G. Ramu, D. J. Zrymiak (2009) The Certified Six sigma Green belt, Handbook First Ed. (Pearson).
- 5 T. M. Kubiak and D. W. Benbow (2010) The Certified Six sigma Black belt, Handbook Second Ed. (Pearson).
- 6 Thomas P. and Paul K. (2010) The Six sigma Handbook, A complete guide for green belts, black belts and managers at all levels, Third Ed. (McGraw Hill).

PS02EAST22: OFFICIAL STATISTICS

Unit 1	Introduction to Indian and International statistical systems. Role, function and activities of Central and State statistical organizations. Organization of large scale sample surveys. Role of National Sample Survey Organization. General and special data dissemination systems.	12L`
Unit 2	Population growth in developed and developing countries, evaluation of performance of family welfare programmes, projections of labour force and manpower. Scope and content of population census of India.	12L
Unit 3	System of collection of Agricultural Statistics. Crop forecasting and estimation, productivity, fragmentation of holdings, support prices, buffer stocks, impact of irrigation projects.	12L
Unit 4	Statistics related to industries, foreign trade, balance of payment, cost of living, inflation, educational and other social statistics.	12L

Books Recommended:

- 1 Basic Statistics Relating to the Indian Economy (CSO) 1990.
- 2 Guide to Official Statistics (CSO) 1999.
- 3 Statistical System in India (CSO) 1995.
- 4 Principles and accommodation of National Population Censuses, UNESCO
- 5 Panse, V. G., Estimation of Crop Yields (FAO)
- 6 Family Welfare Yearbook. Annual Publication of D/o Family Welfare
- 7 Monthly Statistics of Foreign Trade in India, DGCIS, Calcutta and other Govt. Publications