C.SJ.M. UNIVERSITY, KANPUR

COURSE STRUCTURE FOR STATISTICS

M.Sc./M.A. (Prev.) 2018 and onwards

S. No.	Paper	Title	Paper Code	Max. Marks
1	Paper-I	Measure Theory, Probability and Distribution	01	80
2	Paper-II	Real Analysis and Stochastic Processes	02	80
3	Paper-III	Linear Methods and Design of Experiments	03	80
4	Paper-IV	Econometrics	04	80
5	Paper-V	Dissertation	-----	80
6	Paper-VI	Practical	------	100

M.Sc./M.A. (Final) 2018 and onwards

S. No.	Paper	Title	Paper Code	Max. Marks
1	Paper-I	Statistical Inference	01	80
2	Paper-II	Reliability Theory, Life Distribution & Multivariate Analysis	02	80
3	Paper-III	Sampling Theory and Statistical Quality Control	03	80
4	Paper-IV (Option - I)	Operational Research and C-Programming	04	80
	Paper-IV (Option – II)	Applied Regression Analysis & Demography	04	80
5	Paper-V	Dissertation	-----	80
6	Paper-VI	Practical	------	100
7.	Paper IV (Option-III)	Data Analysis using Statistical Software	04	80

R B Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

C.S.J.M. UNIVERSITY, KANPUR

DETAILED SYLLABUS - STATISTICS

M.Sc. / M.A. (Prev.) Statistics Exam. 2018 and onwards

Paper I — **Measure Theory, Probability and Distributions.**

Unit 1 Sets, sequence of sets and their limits, fields and sigma fields, Minimal sigma field, Monotone classes of sets, Borel sigma field. Set function, continuity of set function, Measure function, properties of measure function, Probability measure, Caratheodory Extension Theorem of measure function (Statement only). Lebesgue Measure and Lebesgue - stieltjes measure.

Unit 2 Measurable function - its descriptive definition and properties, simple and elementary functions, construction of measurable functions. Random variable, sequences of measurable function and Random variables. Convergence of measurable functions and random variables - almost everywhere convergence, almost sure convergence, covergence in distribution (law). Helly - Bray Theorem (without proof).

Unit 3 Borel - Cantelli lema, Borel 0-1 law, weak & strong law of large number for independent random variables, Kolmogorov's inequality and theorem, Levy's inequality and Chebyshev's inequality.

Unit 4 Central Limit Theorems : Lindberg - Levy Theorem, Laplace - Liapounoff Theorem, Lindberg - Feller Theorem (without Proof) Characteristics functions, inversion theorem. Continuity Theorem and its application.

Unit 5 Sampling Distribution of

i. Mean and Variance, Non-Central Chi-square, t and F Statistics and their properties.
ii. Order statistics and sample range.
iii. Sample correlation coefficient and its use.

R.B. Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

References

Halms, P.R. (1964)	Measure Theory, (Affiliated East - West Press Pvt. Ltd.)
Bhat, B.R. (1985)	Modern Prob. Theory, (Wiley - Eastern Limited).
Ash, R (1972)	Real Analysis & Probability; (Academic Press).
Berberian S.K. (1965)	Measurement and Integration; (Collier - Macmillan Ltd., London).
Loeve, M. (1968)	Probability Theory (Affiliated East - West Press Pvt.Ltd.)
Chow Y.S. & Teicher H (1979)	Probability Theory; (Narosa Publishing House)
Fisz, M	Probability Theory & Mathematical Statistics, II ed; (John Wiley).
Goon, Gupta & Das Gupta	An out line of statistical Theory Vol. I; (World Press, Kolkata).
Arnold, B.C. Balkrishnan, N. and Nagaraja, H.N. (1992)	A First Course in Order Statistics (John Wiley).

Paper II **Real Analysis and Stochastic Process**

Unit 1 Real valued functions, continuity of functions of one variable, uniform continuity. Differentiability, Mean value Theorem, Taylor's theorem with statements of various remainder terms.

Maximum - Minima of functions of many variables (Method of undetermined multipliers only).

Unit 2 Fundamental theorem and Mean value theorem of integral calculus, Test of convergence of infinite integrals, uniform convergence of improper integrals, differentiations under the sign of integral.

Unit 3 Multiple integrals and their evaluation by repeated integration, change of variables in multiple integration, Drichlet's Multiple integral.

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Stochastic Process : Its introduction (Definition & Examples) and classification into discrete/continuous time, discrete/continuous state spaces, types of stochastic processes with elementary problems.

Unit 4 Markov Chains : Definition & examples of Markov chain, Chapmann - Kolmogorove equations, Calculation of n-step transition probability matrix and its limit. Stationery distribution, classification of states, transient Markov chain.

Unit 5 Random walk and Gambler's ruin problem. Idea's of Branching Process, Poisson Process, Pure Birth Process, Pure Death Process, Birth & Death Process. Applications from social, physical & Biological sciences.

References

Apostal T.M. (1985)	Mathematical Analysis, [Narosa Pub. House (Indian Ed.)].
Smith	Concepts of Real Analysis.
Rudin, Walter (1976)	Principals of Mathematical Analysis.
Shanti Narain	Mathematical Analysis.
Parzen E (1962)	Stochastic Processes (Holden - day).
Feller, W. (1968)	Introduction to probability and its application Vol. I (Wiley Eastern).
Hoel. P.G.; Port S.C. and Stone C.F. (1972)	Introduction to stochastic Processes (Houghton Miffin & Co.)
Karlin & Taylor H.M.(1975)	A first course in stochastic processes, Vol. 1 (Academic Press).
Cinlar E (1975)	Introduction to stochastic Processes, (Prentice Hall).
Adke S.R. & Manjunath S.M. (1984)	An introduction to finite Markev processes (Willey Eastern)
Bhat BR (2000)	Stochastic Models : Analysis & Application (New Age International, India).

R.B. Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Paper III **Linear Methods & Design of Experiments**

Unit 1 Finite dimensional vector spaces, existence of basis, Orthogonal matrices, Gram - Schmidt orthogonalisation method. Algebra of Matrices, rank and inverse of a matrix, solution of Linear equations, Generalised inverse of a matrix and its elementary properties. Characteristics roots & Vectors of a matrix, Caley - Hamilton Theorem. Idempotent matrices. Real quadratic forms, rank & index, congruence of symmetric matrices, reduction of quadratic forms.

Unit 2 Linear estimations : Linear models with assumption on error components, estimable function, estimation & error spaces, Best Linear Unbiased Estimate (BLUE) for linear functions of parameters,unified theory of BLUE and least square estimate.

Unit 3 Testing of general liner hypothesis under normality of errors. Analysis of variance in general two-way classification. Missing plot techniques.

Unit 4 General Block Design and its information matrix.Criteria of connectedness and orthonormaility, Balanced and Partially blanced design. Analysis of block designs. Extension to row-column designs.

BIBD, recovery of inter & intra block informations in BIBD, Laltice Design, split plot design.

Unit 5 General factorial experiments, factorial effects, best estimates and testing of the significance of factorial effects, study of 2 & 3 factor experiments in randomized blocks. Complete & partial confounding, Fractional replication for symmetric factorials.

R.B. Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

References

Rao, C.R. (1973)	Linear Statistical inference & its applications (2nd Ed.) (John Wiley)
Biswas, S. (1984)	Topics in Algebra of Matrics, (Academic Publication).
Hadley, G. (1987)	Linear Algebra, (Narrosa Publisity House)
Graybill, F.A. (1983)	Matrics with applications in statistics (2nd Ed.) (Wards worth).
Searle S.R.	Linear Models (Wiley)
Searle S.R. (1982)	Matrix Algebra useful for statistics (Wiley).
Chakrabarti M.C.	Mathematics of Designs & Analysis of Experiments (Asia Publishing House).
Joshi,D.D.	Linear Estimation and Design of Experiments (Wiley Eastern).
Das M.N. & Giri N. (1979)	Design and Analysis of Experiments (Wiley Eastern).
Montgomery C.D. (1976)	Design & Analysis of Experiments (Wiley).
Kempthorn,O.	Design & Analysis of Experiments.
Scheffe	Analysis of Variance (Wiley).
Giri N.	Analysis of variance.

R B Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Paper IV **Econometrics**

Unit 1 Nature of Econometrics, The General Linear Model ordinary least squares estimation and prediction. Use of dummy variables, least squares estimates with restriction on parameters. Pure and mixed methods of estimation. Generalized least squares and prediction. Test of significance and confidence intervals, use of orthogonal polynomials.

Unit 2 Heteroscedastic disturbances and its solutions. Autocorrelation, its consequences, Durbin-Waston test. Multicollinearily problem, its implication and tools for handling the problem, its implication and tools for handling the problem. Ridge Regression.

Unit 3 Residuals and their plots as a test for departure from assumptions such as fitness of model, normality, homogeneity of variances, detection of outliers and remedies. Selection of explanatory variables - use of R^2, s^2, Mallows C_p statistics and stepwise regression.

Unit 4 Linear regression with stochastic regressions. Error in variable model and instrumental variable estimation. Autoregressive linear regression. Distributed lag model. Introduction to Non-linear models. Intrinscially non linear models. Linearization (Taylor's series) method of estimation of structural parameters.

Unit 5 Simultaneous linear equation model, Examples. Identification problems : restriction on structural parameters, Rank and order conditions. Estimation in simultaneous equation model. Indirect least squares, 2SLS estimators. General out line of LIML, K-class estimators, 3SLS and FIML estimators.

References

Kontsoyiannis, A. (1979) Theory of Econometrics, (Macmillan Press).

Johnstone, J. Econometric methods III Ed.

Theil, H. Introduction to theory and practice of Econometrics.

Draper N.R. and Smith, H. Applied Regression Analysis, II Ed.

Watherill, G.B. (1986) Regression analysis with applications (Champann Hall).

APK, P.G. (1990) Text Book of Econometrics, (Tata McGraw Hill).

RBTiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

M.A./M.Sc. (Final) Exam. 2018 & onwards

PAPER I STATISTICAL INFERENCE

Unit I Decision Theory : General statistical decision problem, Decision function, Loss and Risk function, Admissibility, Completeness, Minimax and Bay's Principle, Minimax and complete class theorems, Estimation & hydrotheses testing as a decision problem.

Unit II Information in data about the parameters as variation in likelihood function, concept of no information, sufficiency, Neymann - Factorization criteria, Minimal sufficient statistics, expoential families & Pitman families, invariance property of sufficiency under one-one transformation of sample space and parameter space, completeness & bounded completeness, distribution admitting sufficient statistics.

Unit III Methods of Estimation : Methods of ML, Moments and minimum chi-square and their properties, choice of estimators based on unbiasedness, minimum variance, mean squared error, minimum variance unbiased estimator MVUE, Rao-Blackwell Theorm, Completeness, Lahmann-Scheffe Theorem, Necessary & sufficient conditions for MVUE, Cramer-Rao Lower bound approach.

Interval estimation : Confidence level, construction of confidence intervals, shortest expected length confidence interval.

Unit IV **Test of Hypothesis** : Neymann-Person lemma and its generalization, Uniformly Most Powerful (UMP) tests, unbiased tests, UMP unbiased tests, for simple null against simple alternation, simple null against one sided alternatives and one parameter exponential family.

Likelihood ratio (LR tests and its large sample properties, Asymptotic Distribution of LR statistics, confidence sets and their relation with family of tests, Uniformly Most Accurate (UMA) untriased confidence sets.

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Unit V Sequential Procedures, sequential test, SPRT and its properties Wald's inequality, OC and ASN functions, SPRT in Normal & Binomial tests.

Non-parameter tests : Sign test, Wilcoxon-Mann - Whitney Test, Run test, Median test & tests based on Spear man's rank correlation.

References

1. Ferguson T.S. (1967) Mathematical Statistics (Academic Press).
2. Rohatgi V. (1988) An introduction to Probability & Mathematical Statistics (Wiley Eastern)
3. Kde B.K. (1999) A first course on Parameteric inference, Narosha publicity House.
4. Lehmann EL (1986) Theory of Point Estimation (Wiley Eastern) [Latest Ed.]
5. - do - Testing Statistical Hypothesis (Wiley Eastern)
6. Dudewicz E.J. & Mishra S.N. (1988) Modern Mathematical statistics John wiky & sons NY : (International student Ed.)
7. Mood, Greybil & Bose DC Introduction to theory of statistics (McGrass-Hills)
8. Rao CR. (1973) Linear statistical inference & its applications (Wiley Eastern)
9. Gibbons J.D. (1985) Non-parametric Statistical Inference II ed. (Marcel Dekkar).

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

PAPER II **Reliability Theory , Life distribution & Multivariate analysis.**

Unit 1 Basic concepts of reliability and measures. Components and systems, coherent systems; Reliability of coherent system. Hazard rate concept, Poisson process.

Unit 2 Some common life distributions and their properties - Exponential, Wiebull, Gamma, Log normal. Estimation of the parameters of these distribution and estimation of reliability. Idea of two type censored sampling.

Unit 3 Multivariate normal distribution, marginal and conditional distribution, characteristics function and moments, Estimations of the parameters (Maximum likelihood Method). Distribution of sample mean vector.

Unit 4 Wishart matrix - its distribution & properties, Distributions of simple correlation coefficient, partial & multiple correlation coefficient , application in testing & interval estimation. Null distribution of Hotelling, T^2-statistics. Its application in tests on mean vector for one and more multivariate normal populations and also on equality of the components of a mean vector in multivariate population.

Unit 5 Classification and discrimination procedures for discrimination between two multivariate normal populations - sample discriminant functions, tests associated with discriminant functions, probability of misclassification & their estimation.

Idea of Principal components, dimension reduction, Canonical variables and canonical correlation - Definitions & uses.

R B Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

References

1.	Kale, B.K. & Sinha S.K.	Life testing & Reliability estimation.
2.	Mann, Schafer & Singapurwala	Methods of statistical analysis of reliability & life data.
3.	Bain L.J. and Engel hardt (1991)	Statistical analysis of Reliability & Life testing models. (marcel Dekker).
4.	Barlow & Proschan (1985)	Statistical Theory of Reliability and life testing (Holt, Reinharts & Wirston).
5.	Anderson T.W. (1983)	An introduction to multivariate statistical analysis (wiley eastern)
6.	Kshirsagar A.M. (1972)	Multivariate Analysis (Marcel Dekker)
7.	Morrison DF (1976)	Multivariate Statistical Methods 2nd Ed. (Mc Graw Hill).
8.	Srivastava MS & Khatri C.G. (1979)	An introduction to multivariate statistics (North Holland)
9.	Giri NC (1977)	Multivariate statistical inference (Academic Press)
10.	Rao C.R. (1973)	Linear statistical inference & its application (2nd ed.) (Wiley eagtes).
11.	Sharma,S. (1996)	Applied multivariate techniques (Wiley).

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

PAPER III **Sampling Theory and Statistical Quality Control**

Unit 1 Unequal probability sampling : PPS WR/WOR methods (including Lahiri Scheme) and related estimaors of a finite population mean (Desraj and Murthy estimators for a sample of size-2). Hurwitz-Thompson's estimator.

Ratio and Regression estimators based on SRSWOR method of sampling. Ratio and Regression estimates in stratified sampling.

Unit 2 Cluster sampling will equal and unequal sizes. Two stage sampling with equal number of second stage units. Double sampling.

Non sampling errors : obserrational errors and problem of incomplete samples, effects of Non-response. Demings model and randomized response techniques.

Unit 3 **Quality Control** : Its history and uses. Concept of quality and meaning of control. Importance of statistical techniques in Statistical Quality Control S.Q.C. Natural Tolerance limits specification limits. General theory of control charts for attributes and variables / modified control limits, OC and ARL of control charts uses of Runs moving averages charts, CU-SUM charts.

Unit 4 Acceptaqnce sampling plans for attributes inspection : Single, double and sequential sampling plans and their properties. OC, AOQ, ASN and ATI curves and their significance in acceptance sampling paln. Indifference quality.

Unit 5 Acceptance sampling procedure for inspection by variables : Single sampling plan for one sided and two sided specification with known and unknown σ-values. Dodge-Roming tables. MIL Std. Plans. Continuous sampling plans CSP - 1.

R B Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

References

1. Chaudhuri, A. and Mukherjee, R (1988) — Randomized Response : Theory and Techniques, New York : (Marcel Dekker Inc.).
2. Cochran, W.G. — Sampling techniques (3rd Edition, 1977). Wiley
3. Des Raj and Chandak (1998) : — Sampling theory. Narosa Murthy, M.N. (1977)..
4. Murthy M.N. (1977) — Sampling theory and methods. Statistical Publishing Society Calcutta
5. Sukhatme et. al. (1984) — Sampling theory of surveys with applications (Iowa State University Press & IARS).
6. Singh, D and Chaudhury, F.S. (1986) — Theory and analysis of sample survey designs. (New Age International Publishers).
7. Montgomery, D.C. (1985) — Introduction to Statistical Quality Control, [Wiley]
8. Ott, E.R. (1975) — Process Quality Control, [McGrow Hill].
9. Wetherill, G.B. (1977) — Sampling Inspection and Quality Control, [Halsted Press].
10. Wetherill, G.B. and Brown, D.W.C. — Statistical process control theory and practice; [Chapman and Hall].
11. Grant E.L. and Leaven Worth R.S. — Statistical Quality Control.
12. Duncan A.J. — Quality control and Industrial statistics
13. Burr. I.W. — Engineering Statistics and Quality Control.
14. R.C. Gupta — Statistical Quality Control.

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Paper IV (Optional I) Operational Research & C-programming.

Unit 1

Assignment Problems : Introduction, formulation of an assignment problem, assignment algorithm, traveling sales man problem.

Sequencing Problems : Introduction problem of sequencing. Problems with n jobs and 2 machines, problems with n jobs & k machines, problems with 2 jobs & k - machines.

Network Scheduling by PERT/CPM : Introduction, Net work & basic components, Rules of network construction time calculation in networks. Critical Path Method (CPM), determination of critical path & its duration determination of Float and Slack times. Project evaluation and Review Technique (PERT), PERT calculations.

Unit 2

Replacement Problems : Introduction, replacement of equipment or Asset that deteriorates gradually, replacement of equipment that fails completely suddently. Staff recruitment & promotion problem.

Inventory control : Introduction, reasons for carrying inventory, types of inventories and inventory decisions.

Deterministic models - Economic order quality (EOQ) models with & without shortage.

Probabitistic models - (i) Discrete case with no set-up cost model (News paper boys problems). (ii) Continuous case with uniform demand and no set-up cost model.

Simulation : Introduction, types of simulations, simulation, language, advantages & Limitations of simulation technique Generation of random numbers. Monote Carlo simulations, Simulation in Inventory system.

R B Tiwari

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Unit 3 **Theory of Queues :**

Introduction, description of quesues types of queueing models, Poisson process and its properties. Steady State Solution of (i) M/G/1 system (ii) M/M/1 system and (iii) M/M/K system Monte Corlo simulation in quening system.

Unit 4 **C-programing**, Introduction, C-Character set, constants, variables & key words. C-instructions : type declarations, arithmatic, integers and float conversions. Types of conversions in assignment, Hierarchy of operations. Decision control structures : if statement, if - lelse statement nested if else, form of if, use of logical operators, hierarichy of logical operation and conditional operators.

Unit 5 Functions and parameters, input/output, control statements - switch, for, while, do-while, break & continue statements, exit functions, Pointers and references, Arrays and character strings.

References

1. Churchman, Ackoff & Arnoff (1957) — Introduction to operations Research (Johnwiley)
2. Taha H.A. (1982) — Operations Research An Introduction (Macmillan)
3. Hillier F.S. and Liberman (1962) — Introduction to Operations Research (Helden day)
4. Kantiswarup, Gupta P.K. & Singh M.M. (1985) — Operations Research (Sultan Chand).
5. Balaguru Swamy — Programming in ANSI-C (TMH)
6. Kanetker Y.P. — Working with C (BPB Publication)
7. Goltfried, Byron, S. — Theory & problems of programming with C (TMH).
8. Schildt, Herbert — C-The complete Reference, III ed. (TMH).
9. - do - — C-Made Easy (Mcgraw Hill)

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Paper IV (Optional II) Applied Regression Analysis & Demography

Unit 1 Residuals and their analysis, influential observations, Power transformations for dependent and independent variables. Robust & L-1 Regression, Estimation of prediction error by cross - validation and boot straps.

Unit 2 Non-linear regression models, Different methods of Estimation (Least square & Maximum Likeliohood), Asymptotic properties of Estimators.

Generalised Linear models, Analysis of Binary and grouped data by using logistic models, Log-Linear Models.

Unit 3 Coverage and content errors in demographic data, use of Balancing equations and Chandra Sekharan - Deming formula to check completeness of registration data. Adjustment of Age data - use of Whipple, Myer &UN indices. Population composition, dependency ratio.

Unit 4 Measure of fertility, stochastic models for reproduction, distributions of time to first birth, inter-live birth intervals and of number of births (for both homogeneous and non-homogeneous groups of women), estimation of parameters, estimation of parity progression ratios from open birth interval data.

Unit 5 Measures of Mortality; construction of abridged Lifetables. Distribution of life table functions and their estimation.

Stable and quasi-stable population, intrinsic growth rate, models for population growth and their fitting to population data. Stochastic models for population growth.

References

1. Cook & Weisberg (1982)) Residuals & Inferences in Regression (Chapman & Hall).

Dr. R. B. Tiwari
Convener & Head
Dept. of Statistics
D.A-V. College, Kanpur

Proposal to include a new optional paper in M.Sc. / M.A. Final year

(Subject to the permission by the respective Head of the Department)

Need of the Course: The primary needs are to acquaint students with the functionalities of the components of the computer and to abreast them with the latest developments in the computing world thereby enabling them to perform data analysis effectively and efficiently in any specialized statistical software.

Objective of the Course: The objective of the course is to enhance the programming skills and working knowledge of available numerical and statistical software.

Learning Outcomes: The students will be able to use advanced statistical software such as R, SPSS, SYSTAT, MINITAB etc. for the analysis of complex statistical data coming from the various fields like industry, marketing, finance, agriculture and business. The focus of the training will be generation of the software results using appropriate statistical techniques and its interpretation for the real life problems.

M.Sc. / M.A. Final Paper IV (Optional III) ~~Computer Oriented Statistical Methods~~ Data Analysis using Statistical Software.

Details of the syllabus:

Unit-I

Introduction to the statistical software (R/SPSS/any other); Basic File operations: Data objects in R/SPSS, Creating vectors, Creating matrices, Manipulating data, Accessing elements of a vector or matrix, lists, Addition, Multiplication, Subtraction, Transpose, Inverse of matrices. Boolean operators. Looping: For loop, repeat loop, while loop, if command, if else command.

Unit II

Creating Graphs using Software: Histogram, Boxplot, Stem and leaf plot, Scatter plot

Descriptive Statistics: Frequency Distribution, Mean, Median, Range, Variance, Covariance, Skewness, Kurtosis

Unit-III

Statistical Methods (using prescribed Software)

Random number generation: (i) Binomial, (ii) Poisson, (iii) Normal; Statistical Tests: (i) Parametric Tests: Z test, one sample t-test, two sample t-test, Tests for homogeneity of proportions, variances

(ii) Non Parametric Tests: Chi-square test for- independence of attributes, Goodness of fit test ,Run test, Sign test, tests for normality, Wilcoxon one sample test, Kruskal-Wallis test, Friedman test, Median test; Correlation & Linear Regression: (i) Simple and multiple correlation coefficients, (ii) Simple and multiple linear regression models

UNIT IV

Analysis of Variance (ANOVA): (i) One-way ANOVA, (ii) Two-way ANOVA; Multiple comparisons; Analysis of Covariance (ANCOVA); Generalized Linear Model; Simulation application: Monte Carlo Integration, Bootstrapping.

References :

1. Alain F. Zuur, Elena N. Ieno, and Erik Meesters, "A Beginner's Guide to R", Springer, 2009, ISBN:978-0-387-93836-3.
2. W Michael J. Crawley, "Statistics: An Introduction using R", Wiley, 2005, ISBN 0-470-02297-3.
3. Phil Spector, "Data Manipulation with R", Springer, New York, 2008, ISBN 978-0-387-74730-9.
4. Maria L. Rizzo, "Statistical computing with R", Chapman & Hall/CRC, Boca Raton, FL, 2008, ISBN 1-584-88545-9.
5. W. John Braun and Duncan J. Murdoch, "A first course in Statistical programming with R", Cambridge University Press, Cambridge, 2007, ISBN 978-0521872652.
6. Andy Field, "Data analysis using SPSS".

Kal Sahab Ji 16.10.2019 — M Agarwal 16/10/2019. — Nidhi 16/10/2019 — 16.10.19 — R B Singh 16.10.19 (Dr. R.B. Singh Convener)