M.A. /M.Sc. IN STATISTICS

SYLLABUS

(EFFECTVIE FROM 2023-24)
P.G. DEPARTMENT OF STATISTICS
M.P.C. AUTONOMOUS COLLEGE, TAKHATPUR, BARIPADA

OBJECTIVES OF M.A./M.SC. STATISTICS

- To equip learners with the core statistical knowledge from the standpoint of boththeory and applications of statistics;
- To help learners in exploring the applications of statistics in Social Sciences, AppliedSciences and Industries;
- To provide opportunities for continuing education and developing human resourcesin emerging disciplines;
- To provide the knowledge and hands-on training in different areas of statistics;

M.A./M.SC. IN STATISTICS EXAMINATION, 2023 ONWARDS,
(CBCS SYSTEM)
COURSE OUTLINE

	Paper Code	Paper Title	Credits
SEMESTER-I			
CORE COURSES	ST-C-101	Mathematical Analysis and Linear Algebra	5
	ST-C-102	Statistical Methods	5
	ST-C-103	Probability Theory and Distributions-I	5
	ST-C-104	Statistical Inference-I	5
	ST-C-105	Statistical Computing using C language	5
SEMESTER-II			
CORE COURSES	ST-C-201	Probability Theory and Distributions –II	5
	ST-C-202	Statistical Inference-II	5
	ST-C-203	Survey Sampling Methods	5
	ST-C-204	Operations Research	5
	ST-C-205	Statistical Computing-II: Advance Excel and SPSS	5
	SEMESTER-III		
CORE COURSES	ST-C-301	Multivariate Analysis	5
	ST-C-302	Design and Analysis of Experiments	5
	ST-C-303	Applied Stochastic Processes	5
	ST-C-304	Demography	5
	ST-C-305	Statistical Computing-III: R Programming Language	5
ELECTIVE	ST-E-306	Statistical Methods and Probability	5
SEMESTER-IV			
CORE ELECTIVE	ST-C-401	Linear Model and Regression Analysis	5
CORE COURSES	ST-E-402	A. Advance Survey Sampling Methods B. Bio-statistics C. Official Statistics	5
	ST-E-403	A. Time Series Analysis and Statistical Quality Control B. Econometric C. Survival Analysis & Clinical Trials	5
	ST-C-404	Practical Work based on Theory	5
	ST-C-405	Project Work	5

ST-C-101: MATHEMATICAL ANALYSIS AND LINEAR ALGEBRA(100 MARKS)

Course Objectives: The main objective of this course is to introduce students the knowledge of real field and its properties. It will provide grounds for Probability Theory and help them in theoretical and applied researches in Statistics.

Course Learning outcomes:
After successful completion of this course, a student will be able to:

- understand the basic concepts of real analysis including completeness of set, suprimum, infimum, sequence and series.
- understand convergence of sequence and series of real valued function
- understand existence of integral and their evaluation.
- understand change of multiple integral and Lebesgue integral.
- find maxima-minima of functions of several variables.
- understand algebraic methods involving matrices, determinants, Eigen values and Eigen vectors and quadratic forms.

UNIT-I

Sequence and series, convergence, Bolzano-Weirstrass theorem, Heine-Borel theorem.Real valued function, continuous functions, Uniform continuity, sequences and series of functions, Uniform convergence. Differentiation, maxima- minima of functions.

UNIT-II

Functions of several variables, partial and total differentials, maxima-minima of functions, multiple integrals, change of variables in multiple integration, Improper Integrals, Convergence of improper integrals of first and second kinds.

UNIT-III

The Lebesgue integral – length of open sets and closed sets, inner and outer measures. Definition and existence of Lebesgue integral for bounded functions, properties of Lebesgue integral for bounded measurable functions, Lebesgue integral for unbounded functions, Dominated Convergence Theorem and its applications.

UNIT-IV

Matrix: Characteristic roots and vectors, Cayley -Hamilton theorem, minimal polynomial, similar matrices, spectral decomposition of a real symmetric matrix, Hermitian matrix. Real quadratic forms, reduction and classification of quadratic forms.

Books Recommended

1. Ruddin, Walter: Principles of Mathematical Analysis, McGraw-Hill.
2. Goldberg, R.R.: Methods of Real Analysis, Oxford & IBH Publication
3. Apostal, T.M.: Mathematical Analysis, Narosa Publishing House
4. Graybill, F.E.: Matrices with Applications in Statistics, 2nd ed., Wadsworth
5. Searle, S.R.: Matrix Algebra Useful for Statistics, John Wiley & Sons

ST-C-102: STATISTICAL METHODS (100 MARKS)

Course Objectives: This course has been designed to make students familiar with some of the basic methods of analysis of both univariate and bivariate data. Also, this course is to provide a thorough theoretical base in different types of sampling distributions,non-central distributions and categorical data analysis.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand Bivariate data. Significance of various coefficients of correlation(simple, Multiple & Partial).
- understand Fitting of linear and nonlinear curve.
- understand Bivariate probability distribution.
- understand Exact sampling distributions, its properties and applications.
- understand the relationship between the variables/attributes in a givendataset.
- understand categorical data analysis and related inferences.
- apply statistical tools for drawing meaningful inferences.

UNIT-I

Review of Descriptive Statistics, Bivariate and multivariate data, Curve fittings and orthogonal polynomials, regression and correlation analysis, rank correlation, correlation ratio, intra-class correlation.

UNIT-II

Concept of multivariate distribution, multiple regression analysis, partial and multiple correlations, properties of residuals and residual variance. Random sampling, sampling distribution and standard error, standard errors of moments and functions of moments.

UNIT-III

Exact sampling distributions – t, F and Chi-square distributions (Central and Non-central distributions), sampling from bivariate normal distribution, distribution of samplecorrelation coefficient (null case) and regression coefficient, tests based on
t, F and chi-square distributions.

UNIT-IV

Categorical response data, likelihood functions and maximum likelihood estimation, Wald–Likelihood Ratio–Score test triad, statistical inference for binomial and multinomial parameters, theory of attributes.

Books Recommended

1. Mukhopadhyaya, P.: Mathematical Statistics, New Central Book Agency, Calcutta
2. Gun, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory, Vol.II (4th Edition), World Press.
3. Kale, B.K.: A First Course in Parametric Inference, Narosa Publishing House
4. Casella, G. and Berger, R.L.: Statistical Inference. Wodsworth & Brooks Pacific Grove, California.
5. Rao, C.R: Linear Statistical Inference and Its Application. John Wiley.
6. Agresti, A. (2002): Categorical Data Analysis, second Edition, Wiley-Interscience.

ST-C-103: PROBABILITY THEORY AND DISTRIBUTIONS – I(100 MARKS)

Course Objectives: The aim of the course is to pay a special attention to applications of measure theory in the probability theory, understanding of random variables, functions of random variables and various distributions along with their applications.

Course Learning outcomes:
After successful completion of this course, a student will be able to:

understand the basic principles of probability
understand the concepts of random variables, sigma-fields generated by random variables, probability distributions and independence of random variables related to measurable functions.
understand discrete and continuous distributions and their applications,
learn various inequalities and its applications
provide students with the foundations of probabilistic and statistical analysis mostly used in varied applications of real time data.
quantify the chance of an outcomes in the midst of uncertainty.

UNIT-I

Sequence of sets, limsup, liminf and limit of sequence of sets, classes of sets, field, sigma field, minimal sigma field, Borel sigma field, set functions. Measure and its properties, measurable functions and inverse functions. Probability measure, conditional probability, Bayes‟ theorem, independence of events.

UNIT-II

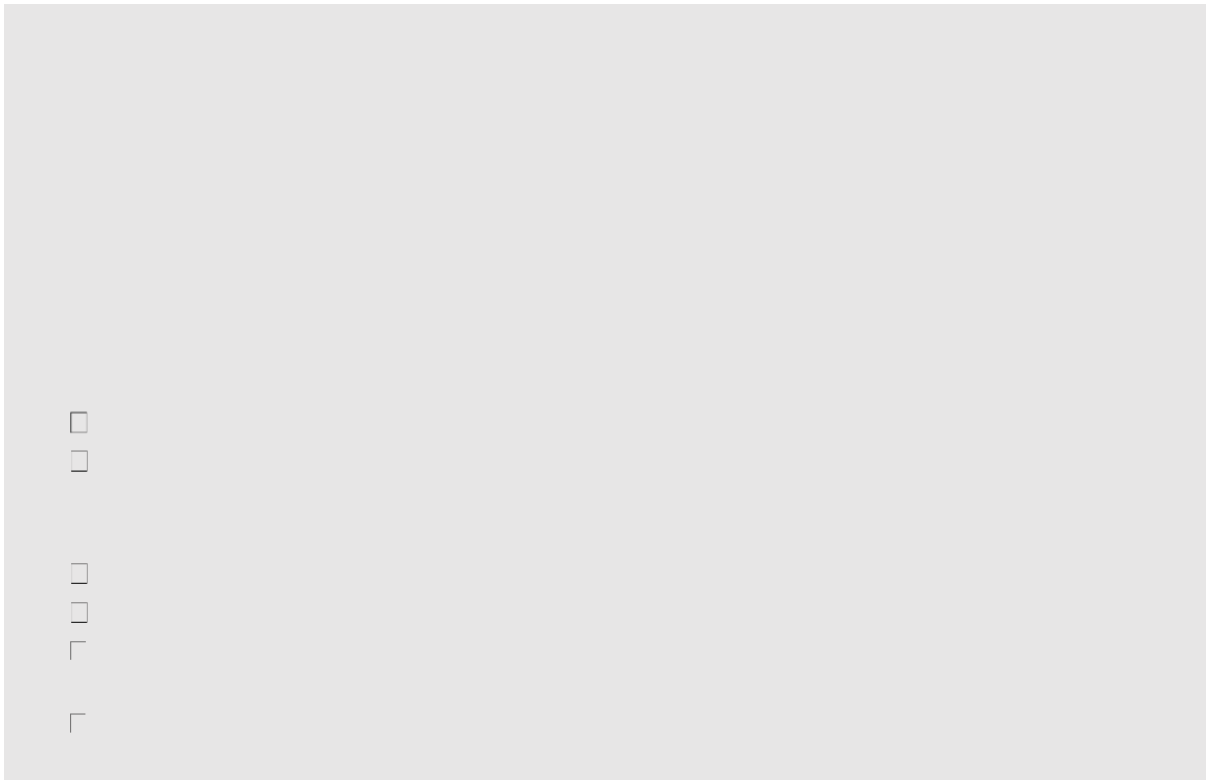
Random variables and probability distributions, distribution function of a random variable. Discrete and continuous random variables, functions of a random variable. Moments, probability generating and moment generating functions and moment inequalities, Characteristic function – definition and properties, inversion theorem, uniqueness theorem, characteristic function and moments.

UNIT-III

Random vectors – distribution function of a vector of random variables, joint, marginal and conditional distributions. Independence of a sequence of random variables. Functions of random vectors and their distributions. Extreme values and their asymptotic distributions. Mathematical expectations. Markov,Holder, Jenson, Liapnov and Chebyshe’s inequalities.

UNIT-IV

Discrete probability distributions – uniform, binomial,Poisson, negative binomial, geometric distributions, hyper geometric, and their properties.
Continuous probability distributions – uniform, normal, gamma and beta,lognormal, Cauchy, Weibull distributions and their properties.



Books Recommended

1. Rohatgi, V.K. and Ehsanes Saleh, A.K.M.: An Introduction to Probabilityand Statistics, 2nd ed., Wiley-Interscience.
2. Bhat, B.R.: Modern Probability Theory, 3rd ed., New Age International.
3. Gun, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory,Vol.I (4th ed.), World Press.
4. Jonson, S. and Kotz, S. (1972): Distribution in Statistics Vol. I-II & III, Houghton and Mifflin.
5. Arnold, B.C, Balakrishnan, N, and Nagaraja, H.N: A First Course in Order Statistics. John Wiley

ST-C-103: STATISTICAL INFERENCE - I(100 MARKS)

Course Objectives: This will help students to understand the basic concepts and methodsof point and interval estimation.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- learn the basic concepts of statistical inference including point estimation and interval estimation
- understand methods of estimation of parameters, methods of obtaining minimum variance unbiased estimators
- understand consistency, CAN estimator, MLE.
- evaluate the properties of these estimators and tests for both finite sample sizesand asymptotically as the sample size tends to infinity.
- build a foundation on inferential statistics which is the basis of higher level mathematical statistics.

UNIT-I

Point estimation, properties of estimators: unbiasedness, consistency, efficiency, sufficiency. Neyman factorization criterion, minimal sufficient statistics, invariance properties of sufficiency, completeness.

UNIT-II

Mean square error, Unbiasedness and minimum variance, Minimum Variance Unbiased Estimators(MVUE), C-R inequality, Cramer-Rao lower bound, Bhattacharya bounds, Rao-Blackwell Theorem, Chapman-Robbins Inequality, Lehmann-Scheffe theorem, necessary and sufficient conditions for MVUE.

UNIT-III

Consistent estimators, sufficient conditions for consistency, efficient estimators. methods of estimation: method of maximum likelihood and its properties, minimum chi-square and modified minimum chi-square methods, method of moments, method of least squares, method of percentiles.

UNIT-IV

Consistent Asymptotic Normal (CAN) estimators and properties of CAN estimators.
Interval estimation, confidence interval and confidence coefficient, confidence belt, theory of confidence sets.

Books Recommended

1. Kale, B.K.: A First Course on Parametric Inference, Narosa Publishing House
2. Rohatgi, V.K. and Ehsanes Saleh, A.K.M.: An Introduction to Probability and Statistics, 2nd ed., Wiley-Interscience.
3. Gun, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory, Vol.II, (4thed.), World Press.
4. George Casella and Roger L. Berger: Statistical Inference. Wodsworth & Brooks Pacific Grove, California.
5. Lehmann E. L & Casella, G.(1999): Theory of Point Estimation. Springer.
6. Rao, C. R: Linear Statistical Inference and Its Applications. Wiley Eastern.

ST-C-105: STATISTICAL COMPUTING-I: COMPUTING USING C LANGUAGE(100 MARKS)

Course Objectives: The paper aims at enriching the computing power of students using spreadsheets and packages like C-programme.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand how to go around with the computing part of some of the theoretical aspects using statistical packages.
- develop computational expertise on topics of linear algebra, distributiontheory and other basic topics of statistics.

C-Programming

Unit 1.

History and importance of C. Components, basic structure programming, Keywords and Identifiers and execution of a C program. Data types: Basic data types, Enumerated data types, derived data types. Constants and variables: declaration and assignment of variables, Symbolic Constants, overflow and underflow of data. Operators and Expressions, library functions. Managing input and output operations: reading and printing formatted and unformatted data.

Unit 2.

Decision making and branching - if…else, nesting of if…else, else if ladder, switch, conditional operator. Looping in C: for, nested for, while, do…while, and jumps in and out of loops. Arrays: Declaration and initialization of one-dim and two-dim arrays. Character arrays and strings: Declaring and initializing string variables, reading and writing strings from Terminal (using scanf and printf only).

Unit 3.

User- defined functions: A multi-function program using user-defined functions, definition of functions, return values and their types, function prototypes and calls. Category of Functions, Preprocesssors, Puppettting of strings.

Unit 4.

Structures, Pointers, File formatting.

Books Recommended

1. Henry Mullish & Hobert Looper, Spirit of C: An Introduction to Modern Programming, Jaico Publishers, Bombay.
2. Kernighan B.W. and Ritchie D.M., C Programming Language, Prentice Hall, Software Series.
3. Gottfried, B.S. (1996). Programming with C, Schaum's Series, Tata McGraw Hill.
4. E. Balaguruswamy. Programming in ANSI C, Tata McGraw Hill. Kanitkar, Y., Let Us C, BPB.

Marks Distribution

Practical Work :	- 80 marks
Viva-voce + Records	- 20 marks

ST-C-201: PROBABILITY THEORY AND DISTRIBUTIONS – II(100 MARKS)

Course Objectives: The aim of the course is to pay a special attention to applications of measure theory in the probability theory, order statistics, convergence, understanding of Weak Law of Large Numbers, Strong Law of Large Numbers and the Central Limit Theorem with their applications.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

gain the ability to understand the concepts of measurable functions, sequence of random variables, convergence, modes of convergence.

learn the concepts of weak and strong laws of large numbers and central limit theorem.

learn how to model product failure, droughts, floods and other extremeoccurrences.

understand characteristic function and its applications

have good concepts of each and every topic of distribution theory becausedistribution theory is the heart of statistics and almost every topic of Statistics need the concepts of distribution theory.

UNIT-I

Bivariate normal and bivariate hyper geometric distributions. Exponential family of distributions. Order statistics and their distributions

UNIT-II

Convergence on a probability space – convergence in distribution (law), convergence in probability, convergence in r-th mean, convergence almost surely and their relationships.

UNIT-III

Convergence of distribution function and characteristic function. Helly-Bray theorem, Extended Helly-Bray theorem, continuity theorem, Borel-Cantelli lemma.

Integration: simple ,non-negative, general measurable function , integrability, Monotone convergence theorem, Dominated convergence theorem, Fatou's lemma.

UNIT-IV

Laws of large numbers – Chebyshev‟s, Khinchin‟s, and Bernoulli‟s laws of large numbers. Hajek-Reni and Kolmogorov inequalities (statements only) and Kolmogorv‟s strong law of large numbers. Central limit theorem – Lindberg –Levy andLiapounov forms with proofs and applications. Lindberg-Feller form (without proof).

Books Recommended

1. Rohatgi, V.K. and Ehsanes Saleh, A.K.M.: An Introduction to Probability andStatistics, 2nd ed., Wiley-Inter Science
2. Bhat, B.R.: Modern Probability Theory, 3rd Edition, New Age International.
3. Gun, A.M., Gupta, M.K. and Das Gupta, B.: An Outline of Statistical Theory,Vol-I (4thed.), World Press
4. Ash, R.B. and Doleans-Dade, C.A.: Probability and Measure Theory. Elsevier.
5. Billingsley, P: Probability and Measure. John Wiley.
6. Sen, A. K: Measure and Probability. Narosa Publishing House.
7. Feller, W: An Introduction to Probability Theory and its Applications, Vol I. John Wiley.

ST-C-202: STATISTICAL INFERENCE-II (100 MARKS)

Course Objectives: The aim of the course is to make students aware of conceptof Testing of Hypotheses and non-parametric approaches.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- Understand the concepts of likelihood ratio test, monotone likelihood ratio test and similar test.
- Understand the use of sequential probability ratio test and various non- parametric methods.
- Identify appropriate statistical inference techniques from a given research orapplied problems and perform correct statistical analysis using different inferential techniques and tests.
- Understand different non-parametric methods.
- Gather advanced knowledge in inference extending which they can learn topics like Bayesian Data Analysis, sequential techniques

.

UNIT-I

Tests of hypothesis, concepts of critical regions, test functions, two kinds of errors, size function, power function, level, MP and UMP test, Neyman-Pearson Lemma, MP test for simple null against simple alternative hypothesis. UMP tests for simple null hypothesis against composite alternative.

UNIT-II

Type A and type A1 tests, similar tests, tests having Neyman structure, likelihood ratio test, one-tailed and two-tailed likelihood ratio tests for mean and variance of normal populations, Asymptotic property of LRT and applications, monotone likelihood ratio test and applications.

UNIT-III

Wald‟s sequential probability ratio test and its properties, OC and ASN function, derivation of OC and ASN functions, Efficiency of SPRT, SPRT for a composite hypothesis.

UNIT-IV

Non-parametric tests: Kolmogorov-Smirnov test, sign test, Wilcoxon signed rank test, Wilcoxon paired sample signed rank test, Mann-Whitney U-test, Krushkal- Wallis test, Freedman‟s test.

Books Recommended

1. Mukhopadhyaya, P.: Mathematical Statistics, New Central Book Agency, Calcutta
2. Gun, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory,Vol. II (4th Edition), World Press.
3. Kale, B.K.: A First Course in Parametric Inference, Narosa Publishing House
4. Casella, G. and Berger, R.L.: Statistical Inference. Wodsworth & Brooks Pacific Grove, California.
5. Rao, C.R: Linear Statistical Inference and Its Application. John Wiley.
6. Agresti, A. (2002): Categorical Data Analysis, second Edition, Wiley-Interscience.

ST-C-203: SURVEY SAMPLING METHODS
(100 MARKS)

Course Objectives: The main objective of this course is to enable students to learn techniques in survey sampling with practical applications in daily life which would be beneficial for the students to their further research.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- learn basic concepts in Sampling Theory.
- explore various sampling techniques viz., SRS, Stratified and systematic sampling and understand their merits and drawbacks.
- understand cluster and two stage sampling procedure and its applications
- understand auxiliary information and its use in sampling estimation.

UNIT-I

Basic concepts of finite population and sampling techniques. sampling design and sampling strategy, simple random sampling with and without replacement, determination of sample size.

Stratified random sampling – estimation of population mean/total with standard error and its estimate, problems of allocations, comparison of variance for fixedsample size, comparison with unrestricted sampling.

UNIT-II

Systematic sampling – method of selection, estimation of population mean/total, sampling variance, comparison with simple random sampling and stratified sampling, efficiency for structural populations.

UNIT-III

Cluster sampling – equal size, estimation of population mean/total, standard error and its estimation, comparison with mean per unit estimator.

Two-stage sampling with equal first stage units, estimation of population mean/total, standard error and its estimation, comparison with single-stage sampling, three-stage sampling.

UNIT-IV

Use of auxiliary information in sample surveys, methods of estimation – ratio, product, difference and regression methods, sampling variance and efficiency of the estimators, multivariate ratio estimator (Olkin‟s estimator), double sampling.

Books Recommended

1. Cochran, W.G.: Sampling Techniques, 3rd ed., Wiley
2. Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C.: Sampling Theory of Surveys With Applications, Indian Soc. of Agric. Stat., New Delhi
3. Swain, A.K.P.C.: Finite Population Sampling – Theory & Methods, South Asian Publishers
4. Sampath, S: Sampling Theory and Methods. Narosa Publising House.
5. Murthy, M. N: Sampling Theory and Methods. Statistical Publishing Society

ST-AE-204: OPERATIONS RESEARCH
(100 MARKS)

Course Objectives: This paper shall expose the students to different aspects of linear programming and operations research. Linear programming, inventory management, network analysis and transportation models are commonly used to set up strategy indifferent real life situations including business.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- learn how to convert a real-life problem into mathematical model, place the constraints in the form of equations and solve the problems under a given set of constraints.
- understand transportation & assignment problem, and also inventory control.
- understand the concepts of game theory and methods of solutions to two- person zero sum games
- understand the theoretical basis of the mathematical models governing queues, waiting time for getting a service, average number of customers ina queue and so on in both real and virtual queues.

UNIT-I

Definition and Scope of Operations Research: phases in operation research, models and their solutions, decision making under uncertainty and risk, use of different criteria, sensitivity analysis, duality theorem, economic interpretation of duality, Karmakar interior point algorithm.

UNIT-II

Transportation, assignment and transhipment problems, travelling salesman‟s problem,non-linear programming – constrained optimization and Kuhn-Tucker conditions, Wolfe‟s and Beale‟s algorithm.

UNIT-III

Analytical structure of inventory problems, Harris EOQ formula, its sensitivity analysis, extension allowing quantity discounts and shortages, probabilistic inventory problems, Models with random demand, the static risk model.
Network scheduling by PERT/CPM.

UNIT-IV

Game Theory: Two-person zero-sum game, maximin-minimax principle, games without saddle points.
Queuing systems and their characteristics, transient and steady state solutions in Poisson queues (M/M/1 and M/M/c models), non-poison queuing systems

Books Recommended

1. Taha, H.A. (1992): Operational Research: An Introduction, Mc. Millan.
2. Kantiswarup, Gupta, P.K. and Man Mohan (2007): Operations Research,Sultan Chand & Sons.
3. Ravindran, A., Phillips, D.T. and Solberg, J.J. (2009): Operations Research: Principles and Practice, Wiley-India.
4. Rajasekharan, S. and Pai, G.A.V. (2006): Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI.

ST-C-205: STATISTICAL COMPUTING-I: COMPUTER APPLICATIONS AND DATA PROCESSING USING ADVANCED EXCEL & SPSS (100 MARKS)

Course Objectives: The paper aims at enriching the computing power of students using spreadsheets and packages like Microsoft Excel and SPSS. Course Learning outcomes: After successful completion of this course, a student will be able to: • understand how to go around with the computing part of some of the theoretical aspects using statistical packages. • develop computational expertise on topics of linear algebra, distribution theory and other basic topics of statistics.

Data analysis using Excel and SPSS

I. Frequency distribution, measures of central tendency, dispersion, moments, skewness and kurtosis

II. Correlation, regression, rank correlation

III. Test of hypothesis - t and F tests, chi-square test, test

IV. Fitting of distributions.

Books Recommended

1. Rajaraman,V, "Fundamentals of Computers", PHI
2. Norton , Peter (2001), "Introduction to Computers", 4th Ed., TMH.
3. Berk, K.N. & Carey, P. (2000): Data Analysis with Microsoft Excel, Duxbury Press

Marks Distribution.

Practical Work : - 80 marks

Viva-voce + Records- 20 marks

ST-C- 301: MULTIVARIATE ANALYSIS
(100 MARKS)

Course Objectives: The main objectives of this course are to deal with the data analysis involving several variables simultaneously with special reference to multivariate normal distribution. Necessary theoretical deductions of different multivariate techniques and deduction of multivariate probability distributions.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand the analysis of real-life data using multivariate tools like- factor analysis, discriminant analysis, cluster analysis, principal component analysis are also taught using appropriate statistical package.
- understand hotelling T2 and Mahalanobis – D^2 statistic and its applications
- perform multivariate data analysis on real life data using statistical packages, interpret the results and in addition shall develop necessary theoretical and mathematical understanding of the multivariate processes.

UNIT-I

Multivariate normal distribution – distribution of linear combination of normally distributed variables, marginal and conditional distributions, distribution of quadratic forms. Random sampling from normal distribution, maximum likelihood estimators of parameters, distributions of sample mean vector and matrix of corrected sum of squares and cross products.

UNIT-II

Estimation of partial and multiple correlation coefficients and their sampling distributions (null case only). Hotelling"s T^2 statistic – properties, distribution and uses, tests on mean vector for one and more multivariate normal populations and also on equality of the components of a mean vector in a multivariate normal population. Mahalanobis – D^2 statistic and its use.

UNIT-III

Cluster Analysis, Wishart matrix – distribution and properties, characteristic function, reproductive property, marginal and conditional distributions. Distribution of sample generalized variance.

UNIT-IV

Factor Analysis, Principal components – definition, MLE of principal componentsand their variances. Canonical variables and canonical correlations – definition, use, estimation and computation.

Books Recommended

1. Anderson, T.W.: An Introduction to Multivariate Statistical Analysis, 2nd ed., Wiley
2. Morrison, D.F.: Multivariate Statistical Methods, 2nd ed., McGraw-Hill
3. Giri, N.C: Multivariate Statistical Inference. Academic Press, NY
4. Rao, C.R: Linear Statistical Inference and Its Application. John Wiley.
5. Sharma, S: Applied Multivariate Techniques, John Wiley.

ST-C-302: DESIGN & ANALYSIS OF EXPERIMENTS
(100 MARKS)

Course Objectives: This course provides the students with the ability to understand the design and conduct experiments, as well as to analyse and interpret data.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand the meaning of randomization, replication, local control and contrast
- make use of analysis of variance-one way, two-way with equal and unequal numberof observations per cell along with analysis of covariance.
- identify the common and important types of experimental designs with respectiveadvantages and disadvantages in terms of power, cost and time.
- understand and use factorial experiments, fractional factorial experiment and confounding in experiments.
- choose an appropriate design in a given research setting and interpret the modeland report the findings scientifically.
- suggest appropriate experimental designs for agricultural and livestock experiments so as to minimize the experimental error.

UNIT-I

Analysis of variance – components and models, analysis of variance of one-way and two-way fixed and random effect models, Analysis of unbalanced data. Principles of designs of experiment, experimental error and data interpretation.

UNIT-II

Complete block designs - completely randomized designs, randomized block designs, latin square designs, Graeco-Latin square designs, cross-over designs. Missing plot techniques.

UNIT-III

Analysis of covariance. General factorial experiments, study of 2^n, 3^2, 3^3 factorial experiments in randomized blocks.
Confounding in 2^n, 3^2 and 3^3 factorial experiments - complete and partial confounding

UNIT-IV

Incomplete block designs – balanced incomplete block design, parametric equality and inequality, intra-block analysis, analysis with recovery of inter-block information. Split plot and strip plot designs – models and analysis.

Books Recommended

1. Das, M.N. and Giri, N.C.: Designs of Experiments, New Age International.
2. Kempthorne, O.: Design and Analysis of Experiments, Wiley Eastern.
3. Gun, A.M., Gupta, M.K. and Dasgupta, B.: An Outline of Statistical Theory, Vol.II, (4^{th} ed.), World Press.
4. Dey, Aloke: Theory of Block Designs. New Age International.
5. Dean, Angela and Voss, Daniel: Design and Analysis of Experiments. New Age International.
6. Chakrabarty, M.C.: Mathematics of Design of Experiments. Asian pub.House.
7. Montgomery, C.D.: Design and Analysis of Experiments. John Wiley, New York.

ST-CE- 303: APPLIED STOCHASTIC PROCESSES
(100 MARKS)

Course Objectives: The main objective of this course is to develop awareness for the use of stochastic models for representing random phenomena evolving in time. **Course Learning outcomes:**
After successful completion of this course, a student will be able to:

- understand the meaning of stochastic process, Markov chain, and transition probability matrix along with classification of stochastic process.
- identify the states and stationary distribution of Markov Chain along with distribution of Markov chain at a given time.
- understand the concepts and applications of random walk and Gambler‟s ruin problem, Brownian motion, Wiener Process, Branching process and renewal process.
- finally, students are expected to choose appropriate stochastic processmodel(s) for a given research in applied problem and apply the theory to model real phenomena and solve several problems concerning random behavior in different fields of applied science.

UNIT-I

Notations and specification of stochastic process, stationary process, martingales, random walk and ruin problems, expected duration of the game, generating function of the duration of the game and for the first passage times, random walk in the plane and space. Markov chains - classification of states and chains, and related problems.

UNIT-II

Determination of higher transition probabilities, stability of a Markov system, limiting behavior of finite irreducible chains, ergodic theorem, graph theoretic approach, reducible chains, ergodic theorem for reducible chains (without proof), finite reducible chains with a single closed class and with more than one closed class.

UNIT-III

Markov processes with discrete state space – Poisson process and its properties, poison process and related distributions, generalization of poisson process – pure birth process, Yule-Furry process, birth-immigration process, pure death process, birth and death processes.

UNIT-IV

Markov processes with discrete state space – Champman-Kolmogorov forward and backward equations, derivation of poison process, pure birth process, pure death process by using Chapman-Kolmogorov equations

Books Recommended

1. Medhi, J. (1982): Stochastic Processes, Wiley Eastern.
2. Feller, W. (1968): Introduction to Probability and its Applications, Vol.1, Wiley Eastern.
3. Hoel, P.G, Port S.C. and Stone, C.J. (1972): Introduction to Stochastic Processes, Houghton Miffin and Co.
4. Karlin, S. and Taylor,H.M. (1975): A First course in Stochastic Processes, Vol.1,Academic Press.

ST-C-304: DEMOGRAPHY
(100 MARKS)

Course Objectives: The main objective of this course is to describe current population trends in terms of fertility, mortality and population growth and the concepts stable population.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand content and coverage errors, different indices
- understand Population growth models and projections
- understand concepts of fertility and fertility models
- understands construction of life tables and its applications
- learn birth intervals and related models
- understand concepts of migration and related models
- understand the basic concepts of stable population theory

UNIT-I

Sources of demographic data, Coverage and content errors in demographic data, Chandrasekharan Deming formula. Adjustment of age data, Whiples, Mayers and UN indices. Population projection methods: Component & Growth Models, Leslie Matrix, Population distribution: Lorenz curve and Gini concentration ratio,
Population pyramid.

UNIT-II

Measures of fertility (period and cohort), Coales fertility index, Measures of reproduction, Calculation of PPR, Fertility models, Birth Intervals. Nuptiality rate, Net Nuptiality table, Proportion Single and Singulate. Mean age at marriage, Hajnal‟s method of estimating SMAM, Mean duration of fertile union.

UNIT-III

Measures of mortality, comparative mortality index, Lexis Diagram and IMR, lifetable functions, Construction of Reed Merell, Greville life table, UN and Coale-Demeny model life tables, multiple decrement life table, measures of morbidity.

UNIT-IV

Measures of internal migration & international migration methods of estimation, Migration models. Stationary and stable population models, Simplified example of stable population, Lotka‟s demonstration of conditions producing a stable population, the equations characterizing a stable Population, Identification of the intrinsic growth rate.

Books Recommended

1. Pathak, K.B. and Ram, F.: Techniques of Demography Analysis, Himalayan Publishers
2. Srinivasan, K.: Basic Demographic Techniques and Applications, Sage Publishers
3. Ramkumar, R.: Technical Demography, Wiley Eastern.
4. S.H. Preston, P. Heuveline & M. Guillot, Blackwell, 2003_-Demography
5. Applied Mathematical Demography by Nathan Keyfitz, Springer Verl

ST-C- 305: STATISTICAL COMPUTING – III: R PROGRAMMING LANGUAGE (100 MARKS)

Course Objectives: This paper aims at enriching the computing power of students by using R programming.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand how to read data, data frame and data types.
- understand matrix operations and simultaneous equation solving
- draw high-end graphs using various graphical parameters
- compute descriptive statistics and fit simple models

Data types in R: numeric, character, logical; real, integer, complex, strings and the paste command, matrices, dataframes, lists, setwd, read.table, read.csv, write.matrix, write.csv, creation of new variables, categorisation, cut, factor; round, apply, creation of patterned variables, saving output to a file; source; print, saving workspace/history.

Graphics in R: the plot command, histogram, barplot, boxplot, points, lines, segments, arrows, paste, inserting mathematical symbols in a plot, pie diagram, customisation of plot-setting graphical parameters, text and mtext, the pairs command, colours and palettes. Vector matrix operations: matrix operations, addition, subtraction, multiplication, linear equations and eigenvalues, matrix decomposition and inverse, the linear model and qr decomposition, determinant, g inverse, finding a basis, orthonormalisation, finding rank.

Books Recommended

1. **Randall L. Eubank and Ana Kupresanin: Statistical Computing in**

C++ and

R. Chapman &Hall/CRC The R Series.

2. **Verzani, John. Using R for Introductory Statistics. Taylor & Francis.**

Marks Distribution

Practical Work : - 80 marks Viva-voce + Records - 20 marks

ST-E-306: – Statistical method and probability theory (100 MARKS)

Course Objectives: The aim of the course is to pay a special attention to applications of measure theory in the probability theory, order statistics, convergence, understanding of Weak Law of Large Numbers, Strong Law of Large Numbers and the Central Limit Theorem with their applications.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- gain the ability to understand the concepts of measurable functions,sequence of random variables, convergence, modes of convergence.
- learn the concepts of weak and strong laws of large numbers and central limit theorem.
- learn how to model product failure, droughts, floods and other extreme occurrences.
- understand characteristic function and its applications
- have good concepts of each and every topic of distribution theory because distribution theory is the heart of statistics and almost every topic of statistics need the concepts of distribution theory.

UNIT-I

Descriptive Statistics: Measures of central tendency, dispersion, skewness and kurtosis for the study of nature of data. Idea of correlation and regression for two and three variables; correlation coefficient, correlation ratio, multiple and partial correlations

UNIT-II

Probability: Introduction, random experiments, sample space, events and algebra of events, definition of probability-classical, statistical, and axiomatic. Conditional probability, laws of addition and multiplication, independent events, theorem of total probability, bayes' theorem and its applications.

UNIT-III

Random variables: Discrete and continuous random variables, p.m.f., p.d.f., c.d.f., Iiiustrations of random variable and its properties. Expectation, variance, moments and moments generating function.

UNIT-IV

Some discrete statistical distributions: Binomial, Poisson, hyper geometric, negative binomial and multinomial distributions. Some continuous distributions (Normal, Uniform, Exponential,), Bivariate normal distributions and their properties.

Books Recommended

1.Gupta, S C and Kapoor, V.K.(2008): Fundamentals of M athematical Statistics,
2.Hogg, R.V.,Tanis.E.A.and Rao J.M(2009):Probability and statistical inferences.

ST-C- 401: LINEAR MODELS AND REGRESSION ANALYSIS
(100 MARKS)

Course Objectives: The main objective of this course is to introduce linearmodels and regression modellings, e g simple, multiple and logistic.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand the concepts of linear models and regression including simple linear regression, multiple regression, inverse regression, non-linear regression, polynomial regression, logistic regression, non-linear growth models.
- study the maximum likelihood estimation for estimating parameters of these models and testing of hypothesis of parameters or functions of parameters.
- finally, students are expected to choose an appropriate linear or non-linear model in a given research setting and interpret the model and report the findings scientifically.
- suggest appropriate regression models for given datasets to predict the behaviour of complex systems or analyse experimental, financial and biological data.

UNIT-I

Regression on the full rank model - methods of estimation and their consequences, distributional properties, general linear hypothesis, testing of common hypothesis and reduced models.

UNIT-II

Regression on dummy variables – regression on allocated codes, regression ondummy (0,1) variables, use of dummy variables on multiple regression.

UNIT-III

Regression models (not of full rank) – consequences and distributional properties. Estimable functions – properties, testing for estimability, general linear hypothesis.

UNIT-IV

Selecting the „best" regression equation – all possible regressions, backward and forwardelimination procedures, step-wise regression procedures.

Multiple regression applied to analysis of variance problems – one way and two way classifications using the models.

Books Recommended

1. Searle, S.R.: Linear Models, John Wiley & Sons
2. Draper, N.R. and Smith, H.: Applied Regression Analysis, John Wiley &Sons.
3. Rao, C.R: Linear Statistical Inference and its Applications, Wiley Eastern Ltd.
4. Kshirsagar, A M: A Course in Linear Models. Marcel Dekker, N. Y.
5. Joshi, D D: Linear Estimation and Design of Experiments. New Age International Publication.
6. Weisberg, S. Applied Linear Regression. Wiley.
7. Chatterjee, S. and Price, B: Regression Analysis by Example. John Wiley, New York.

ST-AE-402(A): ADVANCED SURVEY SAMPLING METHODS (100 MARKS)

Course Objectives: The main objective of this course is to introduce equal andunequal probability proportional to size sampling.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand the basic concepts of probability proportional to size sampling
- understand the unequal probability proportional to size sampling
- understand Basic Concepts, Design-based and model-based Inference
- learn super population concepts
- understand sampling and non-sampling errors, modeling observational error, and randomized response technique to get information for sensitive issues.
- perform different types of sampling procedure in real life situation.
- analyze the data, interpret the results and draw valuable conclusions coming from various aspects.

UNIT-I

Unequal probability sampling with replacement –PPSWR sampling, methods of selection, estimation of mean/total, standard error of estimate and it‟s estimation, comparison with SRSWR, gain due to PPSWR sampling,
Small area estimation – direct, synthetic and composite estimators.

UNIT-II

Unequal probability sampling without replacement – Des Raj's ordered estimator, Murthy's unordered estimator, Horvitv-Thompson estimator and its optimal properties. Midzuno Scheme of Sampling, Rao-Hartly-Cochran sampling procedures, systematic sampling with varying probabilities.

UNIT-III

Variance estimation – methods of random groups, the Jack knife, balanced half sample,and the bootstrap techniques.
Inference under a Super-population Model: Basic Concepts, Design-based and model-based Inference

UNIT-IV

Measurement Errors in surveys – mathematical models for measurement error. Problems of non-response – Hansen and Hurwitz technique, Politz-Simon technique. Randomized response techniques – Warner's model and unrelated question model.

Books Recommended

1. Cochran, W.G.: Sampling Techniques, 3rd ed., Wiley
2. Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. and Asok, C.: Sampling Theory of Surveys With Applications, Indian Soc. of Agric. Stat., New Delhi
3. Swain, A.K.P.C.: Finite Population Sampling – Theory & Methods, South Asian Publishers
4. Murthy, M. N: Sampling Theory and Methods. Statistical Publishing Society
5. Arnab, Raghunath, Survey Sampling Theory and Applications, AcademicPress

ST-AE-402(B):BIOSTATISTICS
(100MARKS)

Course Objectives: Biostatistics is one area of Applied Statistics that concerns itself with the application of statistical methods to medical, biological, epidemiological and health related problems.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- Understand the oncepts of Genetics and Hardy Weinberglaw
- stochasticandepidemiologymodels,reproductionnumber
- concepts of Bio-logical assay, also understands dose-response relationships.
- Different types of epidemiological study design
- Understand sensitivity, specificity and accuracy
- Understand concepts of odd ratio and relative risks

UNIT-I

Basic biological concepts in genetics, Mendels law, Hardy- Weinberg equilibirium, random mating, distribution of allele frequency (dominant/co-dominant cases), Approach to equilibirium for X-linked genes, natural selection, mutation, genetic drift, equilibirium when both natural selection and mutation are operative, detection
And estimation of linkage in heredity.

UNIT-II

Stochastic models in Biology and Epidemiology: Discrete and continuous time stochastic models, Deterministic and stochastic models for epidemics and endemics,interferencemodels,vaccinationmodels,geographicalspread,parasitic diseases, parameter estimation related to latent, infection and incubation periods. Reproduction number, stochastic models for population growth and extinction.

UNIT-III

Types of biological assays, direct assays, ratio estimators, asymptotic distributions, regression approaches for estimating dose response relationships. Quantal responses, methods of estimation of parameters, dose allocation schemes,mediandose,estimationofpointsonthequantalresponsefunction,
Estimation of safe doses.

UNIT-IV

Analysis of Epidemiologic and Clinical Data: Studying association between a disease and a characteristic: (a) Types of studies in Epidemiology and Clinical Research,(b)DichotomousResponseandDichotomousRiskFactor:2X2Tables
(c) Expressing relationship between a risk factor and a disease (d) Inference for relative risk and odds ratio for 2X2 table, Sensitivity, specificity and predictivities

BooksRecommended

1. JainandPrabhakaran:GeneticsofPopulation,SouthAsianPublications.
2. Narain,P.(1990):StatisticalGenetics,JohnWileyandSons
3. Ewens,W.J.(1979).MathematicsofPopulationGenetics,SpringerVerlag.
4. Indrayan,A.(2008).MedicalBiostatistics,SecondEdition,Chapman&Hall/CRC.
5. S.Selvin(1996).StatisticalAnalysisofEpidemiologicData,Oxford University Press.

ST-AE-402(C): OFFICIAL STATISTICS(100 MARKS)

Course Objectives: The main objective of this course is to enable students toknow the official statistical systems in India and functions of different agencies.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand Indian official statistical system
- learn functions of various statistical organizations viz., CSO, NSSO
- understand agricultural statistical system
- understand population growth and economic development

UNIT-I

Introduction to Indian and International statistical systems, Role, function andactivities of Central and State statistical organizations.

UNIT-II

Organization of large-scale sample surveys. Role of National Sample Survey Office. General and special data dissemination systems.

Estimation of national income-product approach, income approach and expenditure approach.

UNIT-III

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.

UNIT-IV

System of collection of Agricultural Statistics. Crop forecasting and estimation, Productivity, fragmentation of holdings, support process, buffer stocks, impact of irrigation projects. Statistics related to industries.

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 Publications of D/o Family Welfare.
7. Monthly Statistics of foreign Trade in India, DGCIS, Calcutta and otherGovt. Publication.

ST–E-403(A): TIME SERIES AND STATISTICAL QUALITY CONTROL(100 MARKS)

Course Objectives: The main objective of this course is to introduce time series modellings and forecasting. It also discusses the methods of statistical quality control.

Course Learning outcomes:

After successful completion of this course, a student will be able to:

- understand Auto-covariance and autocorrelation function and their properties
- understand Exponential smoothing and Holt and winters smoothing techniques
- apply smoothing procedure for forecasting
- understand AR, MA, ARMA and ARIMA models
- understand concepts of quality control and the methods of process control by using the different kinds of quality control charts for variables as well as for attributes along with the methods for product control.
- learn sequential probability sampling scheme

UNIT-I

Time series as discrete parameter stochastic process. Auto-covariance and autocorrelation function and their properties. Exploratory Time Series Analysis, Tests for trend and Seasonality. Exponential and Moving Average Smoothing, Holt and Winters smoothing. Forecasting based on smoothing, Adaptive smoothing.

UNIT-II

Detailed study of the stationary processes: (1) moving average (MA), (2) Auto regressive (AR)., (3) ARMA and (4) AR integrated MA (ARIMA) models, Box Jenkins models, Discussion (without proof) of estimation of mean, auto covariance and autocorrelation functions under large sample theory, Choice of AR and MA periods. Estimation of ARIMA model parameters.

UNIT-III

Industrial statistics – statistical quality control, need for statistical quality control, control charts in general, random and assignable causes, purpose of control charts, process control, control charts for measurements, charts for averages, attributes, defectives and defects

UNIT-IV

Acceptance sampling plans – single and double sampling plans for attributes, producer's and consumer's risk, variable sampling plans, sequential sampling plans. Sequential probability ratio test- OC and ASN functions, sequential tests for testing means of normal and binomial populations.

Books Recommended

1. Box, G.E.P., Jenkins, G. M. and Reinsel, G. C.: Time Series Analysis, Pearson Edition
2. Burr, I.W.: Engineering Statistics and Quality Control, McGraw-Hill
3. Grant, E.L. and Leavenworth, R.S.: Statistical Quality Control, McGraw-Hill.
4. Anderson, T.W. (1971).The Statistical Analysis of Time Series, Wiley, N.V.
5. Montgomerv, D.C. (1985) Introduction to Statistical Quality Control: Wiley
6. Wetherill, G.B. and Brown, D.W. Statistical Process Control. Theory and Practice: Chapman and Hall

ST-E-403(B):ECONOMETRICS
(100MARKS)

Course Objectives: The main objective of this course is to introduce Generalize linear models and simultaneous equation modellings.

CourseLearning outcomes:

Aftersuccessfulcompletionofthiscourse,astudentwillbeableto:

- understandconceptsofgeneralizedlinearmodel
- understand different assumptions of OLS, viz., heteroscedastic, autocorrelation and multicollinearity
- learnstochasticregressionandinstrumentalvariables
- learnsimultaneousequationmodelling

UNIT-I

Nature of econometrics, ordinary least squares (OLS) estimation and prediction, the general linear model (GLM) and its extensions, generalized least squares (GLS) estimation (Aitken estimators) and prediction, heteroscedastic disturbances–nature, OLS estimators in the presence of heteroscedasticity, detection, consequences and remedial measures, pure and mixed estimation.

UNIT-II

Autocorrelation-Nature and reasons of autocorrelation, OLS estimation in the presence of autocorrelation, its consequences and tests. Theil BLUS procedure, estimation and prediction, Multicollinearity- detection, consequences and remedial measures, its implications and tools for handling the problem, ridge regression.

UNIT-III

Linear regression and stochastic regression, instrumental variable estimation, errors in variables, autoregressive linear regression, lagged variables, distributed lag models, estimation of lags by OLS method, Koyck's geometric lag model.

UNIT-IV

Simultaneous equation models – examples, the simultaneous-equation bias. Identification problem – concepts and definitions, under, just or exact and over identifications, rules for identification, test of simultaneity, restrictions on structural parameters, rank and order conditions.

Books Recommended

1. Johnston,J.:EconometricMethods,McGraw-Hill
2. Gujarati,D.:BasicEconometrics,McGraw-Hill.
3. Theil,H.:IntroductiontotheTheoryandPracticeofEconometrics,John Wiley.
4. Apte,P.G.:TextBookof Econometrics,TataMcGraw-Hill.
5. Cramer,J.S.:EmpiricalEconometrics, NorthHolland.
6. Maddala,G.S.:Econometrics,McGraw-Hill.

ST–E-403(C):SURVIVALANALYSISANDCLINICALTRIALS (100 MARKS)

CourseObjectives: Themainobjectiveofthiscourseistointroducesurvival analysis and clinical trials.

Course Learning outcomes:

After successful completion of this course, astudent will be able to:

- understandconceptsofcensoring,survivalandhazardfunctions
- understandvarioussurvivaldistributionsanditsapplications
- understandtheparametricandnon-parametricestimationofsurvival function
- developregressionmodelforsurvival data
- learnvarioustypesofclinicalstudydesign
- understanddifferentphasesofclinicaltrials

UNIT-I

Concept of time, order, Type I, Type II and progressive or random censoring with biological examples, Functions of survival time, hazard function, survival distributions and their applications viz. exponential, gamma, Weibull, Rayleigh, lognormal, Pareto death density function for a distribution having bath-tub shape hazard function.

UNIT-II

Life tables, mean residual life, Non-parametric methods for estimating survival function and variance of the estimator viz. Actuarial and Kaplan –Meier methods. Estimation under the assumption of IFR/DFR. Two sample problem–Gehan test, log rank test.

UNIT-III

Semi-parametricregressionforfailurerate–Cox‟sproportionalhazardsmodelwith one and several covariates, rank testfor the regression coefficient, Competing risk model.

UNIT-IV

Introduction to clinical trials :overview of PhaseI–IV trials, Multi centertrials, Single and double blinding. Design of clinical trials: parallel vs. cross-over designs, cross- sectional vs. Longitudinal designs, review of factorial designs, objectives and endpoints of clinical trials, design of Phase I,II and III trials.

BooksRecommended

1. Kalbfleisch J. D. and Prentice R. (1980): The Statistical Analysis of failureTime data, John Wiley.
2. Kleinbaum,D.G.(1996):SurvivalAnalysis,Springer
3. Lee, Elisa, T. (1992). Statistical Methods for Survival Data Analysis, JohnWiley & Sons.
4. Miller,R.G.(1981).SurvivalAnalysis,JohnWiley& Sons.
5. Piantadosi.S.(1997):ClinicalTrials:AMethodologicPerspective.Wiley and Sons.
6. Friedman,L.M. Furburg,C. Demets,D.L. (1998):Fundamentalsof Clinical Trials. Springer Verlag.
7. Marubeni.E.andValsecchi.M.G.(1994):AnalyzingSurvivalDatafrom Clinical Trials and Observational Studies, Wiley and Sons.

ST-C- 405: PROJECT WORK(100 MARKS)

Industry Exposure – Study Tour Report : 20 Marks
Seminar Presentation : 20 Marks
Project Report : 40 Marks
Viva Voce on Reports : 20 Marks

Remark – Industry Exposure is not compulsory. Those, who will not undertake the tour, will be evaluated for their Project work out of 60 Marks.

The students have to visit an industry or any higher educational institution of repute for enhancing their data analytic skills with their own support before the completion of their final semester examination and submit a brief report of the outcome of their visit to the department. The outcome report will be prepared individually. However, they can prepare by consulting their respective faculty supervisor / guide.

The supervisors are to be allotted to the students before the end of second semester examination and they have to prepare a seminar paper and also a project paper under his/her guidance.

Each student has to give one seminar presentation before the students and faculties on any area of Statistics with his/her interest carrying 20 Marks.

Course objectives: The main objective of this course is to prepare students how to carry out statistical analysis independently.

Course outcomes: After undertaking Industry Exposure Tour and/or project work, a student will be able to:

- analyse statistical data
- write reports based on analysis of data
- secure employment for him/her