DEPARTMENT OF STATISTICS
U.G. PROGRAMME

SYLLABUS

Effective from the Academic Year 2003 - 04

LOYOLA COLLEGE

Autonomous

College Conferred with Potential for Excellence by UGC

Accredited at Five Star Level by NAAC

Chennai - 600 034

DEPARTMENT OF STATISTICS

HISTORY AND PROFILE OF THE DEPARTMENT

The Department of Statistics was established as an independent under-graduate department in the year 1957. In its Silver Jubilee year 1982, the department was upgraded into a post-graduate department with the affiliation of M.Sc.(Statistics) program. In rapid succession, the department advanced further to a research department with the introduction of M.Phil. program in 1985 and Ph.D. program in 1988.

Equipped with just five faculty members before the affiliation of M.Sc. Program, the department had grown in leaps and bounds and has reached the current strength of 14. Of these, all the permanent faculty members possess doctoral degree and the rest possess M.Phil degree .The areas of specialization of the faculty include *Statistical Inference, Reliability Theory, Design of Experiments* and *Sampling Theory.*

The department serves various other departments by way of teaching allied and elective courses and providing consultancy services.

VISION STATEMENT

The Department aims at providing to its students a strong theoretical foundation in Statistics on par with reputed international institutions and at the same time emphasizing application oriented subjects in Statistics and Information Technology.

The students are encouraged to do mini-projects applying Statistical Packages. In some courses at P.G. level, students are encouraged to give classroom presentation of chosen topics so that they can overcome stage fear and develop overall personality. At the UG level, under the restructured pattern, the final year students have the benefit of being trained under the Industry Institute Interaction program.

DEPARTMENT OF STATISTICS

UG - SYLLABUS

SEMESTER - I			CREDITS
ST 1500	:	STATISTICAL METHODS	4
SEMESTER - II			
ST 2500	:	STATISTICAL MATHEMATICS - I	4
CO 2101	:	FINANCIAL ACCOUNTING AND fINANCIAL STATEMENT ANALYSIS	4
SEMESTER - III			
ST 3020	:	COMPUTER LITERACY	1
ST 3500	:	STATISTICAL MATHEMATICS - II	4
EC 3103	:	GENERAL ECONOMICS	
SEMESTER - IV			
ST 4500	:	BASIC SAMPLING THEORY	4
ST 4501	:	DISTRIBUTION THEORY	4
SEMESTER - V			
ST 5400	:	APPLIED STOCHASTIC PROCESSES	2
ST 5401	:	C AND C++	2
ST 5500	:	ESTIMATION THEORY	4
ST 5501	:	TESTING OF HYPOTHESIES	4
ST 5502	:	APPLIED STATISTICS	4
ST 5503	:	COMPUTATIONAL STATISTICS	4
SEMESTER - VI			
ST 6600	:	DESIGN AND ANALYSIS OF EXPERIMENTS	4
ST 6601	:	OPERATIONS RESEARCH	3
ST 6602	:	STATISTICAL PROCESS CONTROL	3
ST 6650	:	STATISTICAL DATA ANALYSIS (SKILL BASED)	10

ST 6650 A : STATISTICAL COMPUTING (2)

ST 6650 B : STATISTICAL DATA ANALYSIS (4)

ST 6650 C : ELEMENTS OF RELIABILITY THEORY (4)

LIST OF SPECIAL ELECTIVES

ST 5400	:	APPLIED STOCHASTIC PROCESSES	2
ST 5401	:	C AND C++	2
ST 5402	:	ACTUARIAL STATISTICS	2
ST 5403	:	ECONOMETRIC METHODS	2
ST 5404	:	MATHEMATICAL ECONOMICS	2
ST 5405	:	DATA BASE MANAGEMENT SYSTEMS	2

ST 1500 - STATISTICAL METHODS

SEMESTER : I **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

Objectives: i) To introduce the basic concepts in Statistics
ii) To develop data reduction techniques

Unit - 1: Definition - Scope and limitations of Statistics - Collection of data - Census - Sampling surveys - Classification and tabulation - diagrammatic and graphical representation of data - Nominal, ordinal and interval scaling.

Unit - 2: Measures of central tendency - Measures of dispersion and Coefficient of variation - Problems based on raw data and grouped data - Moments - raw and central - Measures of skewness - Measures of Kurtosis and their applications.

Unit - 3: Curve fitting - Principle of least squares - linear, nonlinear, exponential and growth curves.

Unit - 4: Correlation - Rank Correlation - Regression analysis - Problems based on raw data and grouped data.

Unit - 5: Association of attributes - Notations - Classes and class frequencies - Consistency of data - Independence of attributes - Yule's coefficient of association - coefficient of colligation.

BOOKS FOR STUDY AND REFERENCE:

Bansilal and Arora (1989). New Mathematical Statistics, Satya Prakashan, New Delhi.

Goon A.M. Gupta. A.K. & Das Gupta, B (1987). Fundamentals of Statistics, Vol.2, World Press Pvt. Ltd., Calcutta.

Gupta. S.C. & Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd. New Delhi.

Kapoor, J.N. & Saxena, H.C. (1976). Mathematical Statistics, Edn8. Sultan Chand and Sons Pvt. Ltd, New Delhi.

ST 2500 - STATISTICAL MATHEMATICS I

SEMESTER : II **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

OBJECTIVES:

i) To introduce the basics in Mathematics with applications in Statistics.
ii) To develop logical deduction and sharpen analytical thinking.

Unit- 1: Combinatorics and Probability : Permutations and combinations. Probability - Classical approach - Addition and multiplication laws - Conditional Probability - Bayes theorem - Simple problems.

Unit- 2: Functions and Random Variables : Functions, bounds, limits, continuity - sequences - convergence/divergence - monotonic sequence.Random variable, distribution function, Probability mass function.

Unit- 3: Infinite series and discrete random variables : Infinite series - absolute / conditional convergence.Tests for convergence - Applications to discrete random variables - Probability generating function (pgf) and moment generating function (mgf).

Unit-4: Differentiability and statistical measures: Higher order derivatives, extreme values. Applications of derivatives to find mode, mean, variance and moments based on mgf and pgf.

Unit-5: Power series and discrete distribution: Power series: Binomial, exponential,geometric and logarithmic series. Applications to discrete distributions: Binomial, Poisson and logarithmic series distributions.

Note: For mathematical results, proofs are not to be discussed.

BOOKS FOR STUDY AND REFERENCE :

Goldberg, R.R. (1970). Methods of Real Analysis - Oxford and IBH.

Hogg, R.V. and Craig, A.T. (2002). Introduction to Mathematical Statistics: Pearson Education, India.

Kapoor, J.N. and Saxena, H.C. (1976). Mathematical Statistics - S. Chand and Co. Ltd.

Khuri. A.I (1993). Advanced calculus with applications in Statistics- John Wiley Inc.

Narayanan, S. and Manickavachagam Pillai, T.K. (1996). Calculus Vol. 1 S. Viswanathan

Publishers (P) Ltd.

Narayanan, S. and Manickavachagam Pillai, T.K.(1996). Algebra S. Viswanathan Publishers (P) Ltd.

Parzen, (1960). Modern Probability Theory - John Wiley & Sons, New York.

Somasundaram, D and Choudhary, B (1996). A first course in Mathematical Analysis - Narosa Publishing House.

CO 2101- FINANCIAL ACCOUNTING AND FINANCIAL STATEMENT ANALYSIS

SEMESTER : II **CREDIT : 4**
TO WHOM : I STATS. **NO. OF HOURS / WEEK : 6**
CATEGORY : AR

Unit 1 : Need for accounting - Double entry book keeping - Journalising - Subsidiary book - Ledger posting - Trial Balance - Bank Reconciliation Statement

Unit 2 : Preparation of Final Accounts of a sole trader with adjustments - company final accounts

Unit 3 : Capital & revenue - accounts of Non-Trading organisations

Unit 4 : Ratio analysis - profitability, solvency and turnover ratio - calculation of ratios given the final statements - preparation of final statements given the ratios

Unit 5 : Statement of sources & Application of Cash

TEXT BOOK:

INTRODUCTION TO ACCOUNTING - T S Grewal

REFERENCE:

ADVANCE ACCOUNTS - Shukla & Grewal

MANAGEMENT ACCOUNTING - S N Maheshwari

ST 3020 - MS-OFFICE

SEMESTER : III **CREDIT : 1**
CATEGORY : CL **NO. OF HRS / WEEK : 3**

Objective:

To equip the students with the knowledge of MS-OFFICE package.

Unit -1: MS-WORD: Introduction to word processing, features of word processing, working with word document, formatting documents - List, tabs and tables, find, replacing and proofing text - Mail Merge, printing and getting help.

Unit -2: MS-EXCEL: Introduction to Electronic Spreadsheets, features of MS-Excel, using sheets in a workbook - cell referencing, ranges and functions -formatting worksheets and creating charts - data forms and printing.

Unit -3: MS-POWERPOINT: Introduction to MS-Power point, presentations, slides, handouts, organization charts, graphs - working with slides, slides show and printing presentation.

Unit -4: MS-ACCESS: Introduction to Access, creating database tables, entering, changing, deleting and displaying data, creating and using simple data-entry forms, queries and reports, setting relationship between tables, using operation, functions and expressions.

BOOKS FOR STUDY AND REFERENCE:

Carry N. Prague and Michael R. Irwin.(1997) Access for Windows 95 Bible. Edition 3.
Katherine Murray. Mastering Power Point
John Walkenbach. Excel for Windows 95 Bible

ST 3500 - STATISTICAL MATHEMATICS II

SEMESTER : III **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

Objectives:

i) To introduce mathematical concepts that will be used in distribution theory.

ii) To develop problem solving skills in univariate and bivariate probability distributions.

Unit -1: Riemann integral and Statistical measures : Riemann integral; Fundamental theorem of integral calculus, Improper integral - Definition continuous type distribution, probability density function. Evaluation of Statistical measures for continuous type distributions - mean, variance, moments and mgf.

Unit -2: Functions of two variables and bivariate distributions : Functions of two variables - limits, continuity - Partial derivatives, extreme values - Lagrange's multiplier - constrained maximum and minimum - Applications to bivariate distributions - Joint distribution function, probability density function and mgf.

Unit -3: Differential equations and applications in probability : First order and second order differential equations. Applications in probability theory and Poisson process.

Unit -4: Double integral and bivariate distributions: Change of order of integration, change of variables. Beta and gamma integrals, moments for bivariate distributions. Transformation of bivariate random variables. Beta and gamma distributions.

Unit -5: Matrix theory and statistical applications : Types of matrices, symmetric, orthogonal, idempotent matrices, determinants, inverse of a matrix, system of linear equations, characteristic roots and characteristics vectors. Statistical applications - Stochastic matrix, generalized variance, dispersion matrix.

Note: For mathematical results , proofs are not to be discussed.

BOOKS FOR STUDY AND REFERENCE

Goldberg, R.R. (1970) Methods of real analysis - Oxford and IBH

Hogg A and Craig AT (2002) Introduction to Mathematical Statistics - Pearson Education, India.

Kapoor, J.N. and Sazena, H.C. (1976) Mathematical Statistics - S.Chand and Co. Ltd.

Khuri, A.I (1993) Advanced calculus with applications in Statistics - John Wiley Inc.

Narayanan, S, and Manickavachagam Pillai - T.K. (1996) Calculus Vol.1 S.Viswanathan Publishers (P) Ltd.

Parzen (1960) Modern Probability Theory - John Wiley & Sons, New York.

Shantinarayan (1993), A Textbook of matrices - S.Chand and Co. Ltd.

Somasundram, D and Choudhary, B (1996) A first course in Mathematical Analysis - Narosa Publishing house.

EC 3103 - GENERAL ECONOMICS

SEMESTER : III **CREDIT : 3**
TO WHOM : STATISTICS **NO. OF HOURS / WEEK : 6**
CATEGORY : AR

Objectives:

i. to have a grasp of the elements of economics
ii. to prepare students to face competitive examinations in Economics

Unit I : Microeconomics

Consumption and Demand; Elasticity concepts; Indifference curves
Production: Agents of production; costs and supply; Isoquants
Market Structure and Determination of prices
Components and theories of distribution

Unit II: Macroeconomics
National Income concepts
Determination of National Income and Employment
Determinants of consumption, saving and investment.

Unit III : Money, Banking and Public finance
Concepts of money and measures of money supply; velocity of money
Banks and credit creation; Banks and portfolio management
Central bank and control over money supply
Determination of the price level
Inflation, Its causes and remedies
Public finance – budgets – taxes and non tax revenues – types of budget deficits

REFERENCES:

Datt, Ruddar and K P M Sundharam, *Indian Economy*, New Delhi, S.Chand and Co. Pvt. Ltd.(Recent edition)

Lipsey, Richard, G., *Introduction to Positive Economics, London*, English Language Society and Weidenfeld and Nicolson (Recent edition)

Samuelson, Paul Anthony and William D. Nordhaus, Economics (Sixteenth Edition) (New Delhi: Tata McGraw Hill Publishing Company Ltd. 1998)

Stonier, Alfred W and Douglas C Hague, *A Test Book of Economic Theory*, London, Longman (Recent edition)

Tyagi, Breham Prakash, *Public Finance*, Meerut: Jai Prakash Nath and Co. (Recent edition)

ST 4500 - BASIC SAMPLING THEORY

SEMESTER : IV **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

OBJECTIVES:

i) To introduce various sampling techniques

ii) To compare the efficiency of various estimators based on different sampling techniques.

Unit - 1: Preliminaries: Sampling Vs Census - Basic concepts of sampling - Population - Parameter - Statistic - Unbiased ness - Mean square error - simple problems.

Unit -2: Simple Random Sampling: Simple random sampling with and without replacement - Estimation of population mean - Variance of estimators - Estimated variance - Simple problems.

Unit -3: Unequal Probability Sampling: PPS Selection - Cumulative total method - Lahiri's method. Hansen-Hurwitz estimator: Its variance and estimated variance. Simple problems.

Unit -4: Stratified Sampling: Estimation of total (mean) - Its variance and estimated variance - Allocation problems - Simple problems.

Unit -5: Systematic Sampling: Linear, Circular, Balanced and Modified systematic sampling schemes. Comparison for populations with one-dimensional linear trend.

BOOKS FOR STUDY AND REFERENCE:

Cochran, W.G.(1971), Sampling Techniques, Wiley Eastern Company Ltd.

Murthy,M.N.(1967), Sampling theory and methods, Statistical publishing society, Calcutta.

Sampath,S.(2000), Sampling theory and methods, Narosa publishing house.

ST 4501 - DISTRIBUTION THEORY

SEMESTER : IV **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

Objectives:

i) To discuss various univariate / bivariate distributions.

ii) To expose the applicability of various distributions in different disciplines.

Unit -1: Joint, Marginal and Conditional distributions. Conditional expectation, conditional variance and correlation coefficient. Stochastic independence.

Unit -2: Discrete distributions: Uniform, Binomial, Poisson, Hypergeometric, Geometric, Negative-Binomial, Trinomial and Multinomial distributions. Their properties.

Unit -3: Continuous distributions: Uniform, exponential, gamma, normal, beta, Cauchy, Laplae, Chi-square, Bivariate normal distributions. Their properties.

Unit -4: Distribution of functions of random variables - Transformation of variables - Chi-square, t and F distributions. Distributions of sample mean and sample variance from a normal population.

Unit -5: Order statistics and their distributions. Simple examples. Limiting distributions - Stochastic convergence - Central limit theorem for iid random variables.

BOOKS FOR STUDY AND REFERENCE:

Brunk, H.D. (1979) An introduction to mathematical statistics.

Dwass, M. (1970) Probability theory and applications.

Goon,A.M., Gupta,M.K. and Dasgupta, B.(1988) An introduction to the statistical theory.

Hogg,R.V and Tanis,E.(1989) Probability and statistical inference, Macmillan publishing house, New York.

Hogg, R.V and Craig, R.T.(2002), Introduction to mathematical statistics, Pearson Education ,India.

Marek Fisz(1962), Probability theory and mathematical statistics, John Wiley and Sons.

Mood,A.M. and Graybill,F.A.(1974), Introduction to the theory of statistics.

Rohatgi, V.K and Saleh , A.K.Md.E.(2002) An introduction to probability and statistics, John Wiley and Sons.

Sanjay Arora and Bansilal, (1989) New Mathematical Statistics

Wilks, S.S.(1962) Mathematical Statistics.John Wiley and Sons,Inc,New York.

ST 5400 - APPLIED STOCHASTIC PROCESSES

SEMESTER : V **CREDIT : 2**
CATEGORY : ES **NO. OF HRS / WEEK : 3**

Objectives:

Unit -1::Elements of stochastic processes - definition and examples. Classification of general stochastic processes.

Unit -2: Markov Chains - definition and examples. Recurrent and transient states, periodicity. Examples. One-dimensional random walk.

Unit -3:Basic limit theorem and its applications - Irreducible Markov Chain, Basic limit theorem - examples.

Unit -4: Stationary distribution of a Markov Chain - existence of a stationary distribution. Illustrations.

Unit -5: Continuous time Markov Chains - Poisson process - marginal distribution of a Poisson process - Pure Birth process - marginal distribution of a Pure Birth process.

BOOKS FOR STUDY AND REFERENCE:

Feller, W. (1957): An Introduction to Probability Theory and its Applications, Vol.1 2nd ed., John Wiley & Sons, New York.

Karlin, S. and Taylor, H. M. (1975): A First Course in Stochastic Processes, Academic Press, New York.

Medhi, J. (1994): Stochastic Processes, Wiley Eastern Ltd., New Delhi.

Ross, S. M. (1983): Stochastic Processes, John Wiley & Sons, New York.

ST 5401 - C AND C++

SEMESTER : V **CREDIT : 2**
CATEGORY : ES **NO. OF HRS / WEEK : 3**

Objective:

To impart programming skills using C and C++

Unit -1:Introduction to "C" : C - character set, Constants, Variables and expressions. Basic structure of a "C" program. Operators - pre-processor directives - Library functions.

Unit -2:Control statements: Decision making statements - loop statements. Arrays - user-defined functions. Introduction to pointers and structures - basic file handling concepts.

Unit -3:C++ programming basics: Basic program construction, comments - constants - variables - expressions - operators - pre-processor directives. Input-output functions. Control statements: Decision making and loop statements.

Unit -4: Structures - functions - passing by reference. Overloaded functions. Objects and classes: Specifying the class - using the class - constructors and destructors - objects as function arguments.

Unit -5: Arrays fundamentals - arrays of objects. Operator overloading. Data conversion. Inheritance - public, private and protected inheritance. Multiple inheritance.

BOOKS FOR STUDY AND REFERENCE:

Balagurusamy, E. (1997): ANSI 'C' Programming, Tata-McGraw Hill Publishers Ltd.

Balagurusamy, E. (2000): Object Oriented Programming C++, Tata-McGraw Hill Publishers Ltd.

Jesse Liberty (1997): Teach Yourself C++, Techmedia, New Delhi.

Jesse Liberty (1999): C++ Unleashed, Techmedia, New Delhi.

Robert Lafore (1988):Object Oriented Programming in Turbo C++, Galgotia Publications Pvt. Ltd., New Delhi.

Yaswant Kanetkar (1997): Let Us 'C', BPB Publications, New Delhi.

ST 5402 - ACTUARIAL STATISTICS

SEMESTER : V **CREDIT : 2**
CATEGORY : ES **NO. OF HRS / WEEK : 3**

Objectives:

(i) To impart basic concepts in actuarial studies
(ii) To prepare students to take up a career in Actuarial Practice

Unit -1: Effective Rate of Interest i - Nominal Rate of Interest $i^{(m)}$ - Force of Interest ä - Relationships between different rates of interest - Expression for ä by use of calculus - Present values - Effective rate of discount d - Nominal rate of discount $d^{(m)}$.

Unit - 2 Annuities - Immediate Annuity - Annuity-due - Perpetuity - Accumulation and Present values of Annuities - Increasing and Decreasing annuities - Annuities and interest rates with different frequencies - Continuous Annuities.

Unit - 3 Analysis of Annuity payments - Capital and Interest elements included in the Annuity payments - Loan outstanding after t payments - Purchase price of Annuities - Annuities involving income tax - Purchase price of an annuity net of tax.

Unit - 4 Stochastic Interest rates - Independent annual interest rates - The definition of S_n - Mean and variance of S_n - Definition of A_n - Mean and variance of A_n - Simple problems.

Unit - 5 Probabilities of living and dying - The force of mortality $ì_x$ - Estimation of $ì_x$ - Uniform Distribution of deaths - Select and Ultimate rates.

BOOKS FOR STUDY AND REFERENCE:

Donald, D.W.A.(1975). Compound Interest and Annuities certain Heinemann, London.

Frank Ayres, J.R. (1983). Theory and problems of mathematics of finance. Schaum's outline series, McGrawHill book company, Singapore.

Mc Cutcheon J.J. and Scott.(1989). Mathematics of Finance. Heinemann, London.Neill, A (1977). Life Contingencies. Heinemann, London.

ST 5403 - ECONOMETRIC METHODS

SEMESTER : V **CREDIT : 2**
CATEGORY : ES **NO. OF HRS / WEEK : 3**

Objectives:

i) To introduce statistical models applicable to real-life situations.
ii) To impart knowledge of inference techniques for economic phenomena.

Unit - 1: Nature of Econometrics - Model building - Role of econometrics - structural and reduced forms.

Unit - 2: The two variable linear model - Least squares estimators - Properties of the least squares estimators - Inference in the least squares model.

Unit -3: The k - variable linear model - Assumptions of the linear model - Ordinary least squares (OLS) estimators - Properties of OLS estimators - Guass-Markov theorem - Inference problems.

Unit -4: Problems in linear model - Multicollinearity - specification error - Autocorrelation - Heteroscedasticity.

Unit -5: Special models - Dummy variables , Lagged variables - Sources of lagged variables - Koyck scheme and Almon lags.

(The emphasis should be on concepts and applications)

BOOKS FOR STUDY AND REFERENCE:

Gujarati , Damodar (1995) . Basic Econometrics. McGraw - Hill Book Company, New Delhi.

Johnston , J.(1984). Econometric Methods. 3rd edn. McGraw - Hill Book Company, New Delhi

Johnson, A.C, Johnson, M.B and Buse, R.C (1989). Econometrics. Macmillan Publishing Company, Inc.New York.

Kelejian, H.H and Oates, W.E.(1989). Introduction to Econometrics. Harper and Rao Publishers , New York.

Kmenta, J.(1971). Elements of Econometrics. Macmillan Publishing Company, Inc. New York.

ST 5404 - MATHEMATICAL ECONOMICS

SEMESTER : V **CREDIT : 2**
CATEGORY : ES **NO. OF HRS / WEEK : 3**

Objectives:

i) To expose the basic concepts and models in Economics
ii) To discuss the applications of Mathematical tools to Economics

Unit -1: Demand function - law of demand, elasticity of demand. Revenue function - marginal and average revenues.

Unit - 2 Supply function - law of supply, elasticity of supply. Cost function - marginal cost and average cost, elasticity of cost.

Unit - 3 Indifference curve - Indifference map, Indifference curve for consumer goods, marginal rate of substitution, rate of commodity substitution, elasticity of substitution.

Unit - 4 Production function - Isoquant, homogenous production function, properties of linear homogenous production function, Cobb - Douglas production function and its properties.

Unit - 5 Perfect competition and imperfect competition. Monopoly and Duopoly. Value determination under monopoly and duopoly.

BOOKS FOR STUDY AND REFERENCE:

Allen, R.G.D. (2000). Mathematical Analysis for Economists, MacMillan. New Delhi.

Chiang, A.C. (2000). Mathematical Economics, McGrawHill book.Co., New Delhi.

Henderson, and Quandt, (1980). Micro-economic theory - a mathematical approach to economics, McGrawHill, Kogakusha, Tokyo.

Mehta, B.C. and Madnani, G.M.K. (1996). Mathematics for Economists, Sultan Chand and Sons, New Delhi.

ST 5405 - DATABASE MANAGEMENT SYSTEMS

SEMESTER : V **CREDIT : 2**
CATEGORY : ES **NO. OF HRS / WEEK : 3**

Objectives:

i) To instantiate an awareness to the database concepts
ii) To manage database effectively through SQL and PL/SQL

Unit - 1 Introduction to Database Systems. Purpose of Database system - Data models - Database languages - Transaction management - Storage management - Database Administrator - Database users - Entity Relationship model: Basic concepts - Mapping constraints - Keys - E-R diagram.

Unit - 2 Basic concepts of Relational database systems. Relational model : structure of Relational Databases - The relational algebra - relational Database design - Normalization using Functional , multi-valued and join dependencies.

Unit - 3 Structured Query Language. SQL - Basic structure - set operations - Nested sub-queries - derived relations - views - modification of database - Joined relation - Data Definition Language (DDL) - Data Manipulation Language (DML) - Data Control Language (DCL).

Unit - 4 Programming Languages through SQL. PL / SQL : Introduction to PL / SQL - Features of PL / SQL - PL / SQL syntax and constructs - SQL within PL / SQL - DML in PL / SQL - Cursors - Procedures - Functions - Packages and Triggers.

Unit - 5 Recent trend in the Data Management Systems. New Applications : Decision Support Systems - Data Analysis - Data Mining - Data Warehousing - Spatial and Geographic Databases.

BOOKS FOR STUDY AND REFERENCE:

Abraham Silberschatz , Henry F.Korth, and S.Sudharshan(1997). Database systems and concepts. Tata McGrawhill Companies Inc., New Delhi.

Scott Urman, (1999). Oracle PL/SQL programming (The authorized Oracle Press Edition): Osborne McGrawHill, New Delhi.

ST 5500 - ESTIMATION THEORY

SEMESTER : V **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

Objective:

To equip the students with various methods of estimation.

Unit -1: Unbiasedness, Consistency - Cramer - Rao inequality - Chapman - Robbin's inequality. Example.

Unit -2: Sufficiency - Factorisation theorem - UMVUE - Properties- Completeness. Rao-Blackwell theorem, Lehmann - Scheffe theorem - Examples.

Unit -3: Methods of estimation: Method of moments - Method of maximum likelihood - Method of minimum chi-square, Method of modified minimum chi-square, Properties of MLE(without proof). Examples.

Unit -4: Elements of Baye's estimation - Prior and Posterior distributions - Examples.

Unit -5: Linear Estimation: Method of least squares - Gauss-Markov model - Estimable function - BLUE.

BOOKS FOR STUDY AND REFERENCE:

Casella, G and Berger,R.L. (1990), Statistical Inference, Wadworth, Inc., Belmont, California.

Goon,A.M., Gupta, M.K. amd Gupta,B.D.(1987) An outline of Statistical Thoery, Vol.II, The World Press Pvt. Ltd., Calcutta.

Hogg, R.V. and Craig, A.T.(2002), Introduction to Mathematical Statistics, Pearson Education (Singapore) (P) Ltd.,

Kale, B.K.(1999), A First Course on Parametric Inference, Narosa Publishing House.

Mood, A.M. Graybill, F.A. and Boes, D.C.(1988), Introduction to the Theory of Statistics, New York; McGraw Hill.

Rohatgi.V.K. and Saleh,A.K.Md.E. (2002), An Introduction to Probability and Statistics, John Wiley and Sons, New York.

Silvey, S.D.(1970), Statistical Inference, Chapman and Hall, London.

ST 5501 - TESTING OF HYPOTHESES

SEMESTER : V **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

Objective:

To introduce the concepts of hypothesis testing (both parametric and Non- parametric) and illustrate with numerical examples.

Unit -1: Statistical hypotheses- simple null hypothesis against simple alternative - Best Critical Region. Neyman -Pearson lemma - Most powerful randomized tests - examples.

Unit -2: One parameter exponential family - families with monotone likelihood ratio property - UMP tests for one-sided hypotheses (without proof) - examples.

Unit -3: Elements of SPRT - Likelihood ratio tests - examples.

Unit -4: Tests of significance - tests based on normal, t, chi - square and F distributions - confidence intervals based on large samples - examples.

Unit -5: Non-parametric methods - Run test for randomness - sign test for location - Median test - Mann-Whitney - Wilcoxon test - Kolmogorov-Smirnov test - one and two sample problems.

BOOKS FOR STUDY AND REFERENCE:

Beaumont, G. P. (1980). Intermediate Mathematical Statistics, Chapman and Hall, New York.

Gibbons, J. D. (1971). Non-parametric Statistical Inference, McGraw-Hill Kogakusha Ltd., New Delhi.

Hogg, R. V. and Craig, A. T. (2002). Introduction to Mathematical Statistics, Pearson Education (Singapore) (P) Ltd.,

Hogg, R. V. and Tanis, E. A. (1983). Probability and Statistical Inference, Maxwell Macmillan international edition, New York.

Mood, A. M., Graybill, F. A. and Boes, D. C. (1983). Introduction to the Theory of Statistics, McGraw-Hill, New Delhi.

Rohatgi, V. K. and Saleh,A.K.Md.E.(2002). An Introduction to Probability and Statistics, John Wiley and Sons. Inc.New York.

ST 5502 - APPLIED STATISTICS

SEMESTER : V **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

Objective:

To discuss various statistical measures applicable in business and economic analysis..

Unit -1: INDEX NUMBERS:Meaning - Classification - Construction of Index numbers - Unweighted index numbers - weighted index numbers - Laspeyre's, Paaschi's, Dorbish-Bowley's, Fisher's, Marshall-Edgeworth and Kelly's method - Quantity index numbers

- Chain index numbers - Base Shiftinf, Splicing and Deflating of index numbers - Consumer Price index number.

Unit -2: TIME SERIES:Concept of time series - Components of time series - additive and multiplicative models - estimation of components - measurement of trend using graphical, Semi-average and moving average methods - method of least squares - measurement of seasonal variation using method of simple averages - ratio to trend method, ratio to moving average method, method of link relatives.

Unit -3:VITAL STATISTICS: Meaning - method of obtaining vital statistics - measurement of mortality - crude death rate - specific death rate - standardized death rate - mortality table - measurement of fertility - crude birth rate - general fertility rate - specific fertility rate - total fertility rate - measurement of population growth - gross reproduction rate - net reproduction rate.

Unit -4: APPLIED REGRESSION ANALYSIS:Partial and multiple regression - partial and multiple correlation.

Unit -5: INDIAN OFFICIAL STATISTICS:Central Statistical Organisation - National Sample Survey Organisation - population census - De Facto and De Jure method - conomic census - agricultural statistics - world agricultural census - livestock and poultry statistics, forest statistics, fisheries statistics, mining and quarrying statistics, labour statistics, national income statistics, methods of national income estimation, financial statistics.

BOOKS FOR STUDY AND REFERENCE:

Agarwal, B. L. (1988), Basic Statistics, Wiley Eastern Ltd. New Delhi.

Gupta S. C. and Kapoor V. K. (1992), Elementary Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Gupta S. C. and Kapoor V. K. (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Kapur,J.N.and Saxena,H.C. (1970), Mathematical Statistics, Sultan Chand and Sons, New Delhi.

ST 5503 - COMPUTATIONAL STATISTICS

SEMESTER : V **CREDIT : 4**
CATEGORY : MC **NO. OF HRS / WEEK : 6**

Objective:

To develop problem solving skills in sampling techniques , statistical inference and business statistics.

Unit -1: SAMPLING THEORY:Drawing samples from different populations using SRSWOR and SRSWR. Estimating variance of population total and mean and comparing with different schemes. Variance minimization and cost minimization in stratified random sampling.

Unit -2: ESTIMATION THEORY : Point estimation by the methods of moments; maximum likelihood and chi-square.

Interval estimation for population proportion, mean, difference of proportions, difference of means and variance.

Unit - 3: TESTING OF HYPOTHESIS :Tests of significance for large and small samples: Tests for proportion, mean, difference of means and variances and using t, Normal, chi-square and F distributions. Chi-test for independence of attributes and goodness of fit.

Non parametric testing: Sign test, median test, run test, rank test and U test.

Unit -4: INDEX NUMBERS : Price and quantity index numbers. Cost of living index number, fixed base and chain base index numbers. Base shifting, splicing and deflating the index numbers.

Unit -5: TIME SERIES:Measuring secular trend by the methods of semi averages, moving averages and least squares. Measuring seasonal variation by the methods of simple averages, ratio to trend, ratio to moving average and link relatives.

BOOKS FOR REFERENCE:

Murthy, M. N. (1967): Sampling Theory and Methods, Statistical Publishing Society, Calcutta.

Pillai, R. S. N. & Bagavathi (1987): Practical Statistics, S.Chand & Company (Pvt.) Limited.

Gupta, S. C. & Kapoor,V. K. (2002): Fundamentals of Applied Statistics, Sultan Chand and Sons Publishers, New Delhi.

Hogg,R.V. & Tanis,E.A. (1983): Probability and Statistical Inference. Macmillan Publishing Company, New York.

ST 6600 - DESIGN AND ANALYSIS OF EXPERIMENTS

SEMESTER : VI **CREDIT : 4**
CATEGORY : MS **NO. OF HRS / WEEK : 6**

Objective:

To provide basic principles of experimentation and discuss the analysis of data relating to agriculture, biological sciences and industry.

Unit -1: Constrasts - linear constraints - orthogonal contrasts - linear models - fixed effect model - random effect model - mixed effect model.

Unit -2: Principles of experimentation - analysis of variance - one-way classification - two-way classification - two-way classification with more than one observation per cell efficiency of two way over one way.

Unit -3: Completely Randomised Design (CRD) - Randomised Block Design (RBD) - Latin Square Design (LSD) - missing plot techniques.

Unit -4: Factorial designs: 2^2, 2^3 and 3^2 factorial designs; confounding and partial confounding.

Unit -5: BIBD: Inter block and Intra block analysis of BIBD. Construction of BIBD (Simple construction).

BOOKS FOR STUDY AND REFERENCE :

Das M.N. and Giri N. (1979), Design and Analysis of Experiments, Wiley Eastern.

Joshi, D.D. (1990), Linear Estimation and Design of Experiments, Wiley Eastern.

Kempthorne, O. (1987), Design and Analysis of Experiments, Wiley Eastern.

Montgomery, D.C. (2000), Design and Analysis of Experiments, John Wiley & sons.

ST 6601 - OPERATIONS RESEARCH

SEMESTER : VI **CREDIT : 3**
CATEGORY : MS **NO. OF HRS / WEEK : 5**

Objective:

To equip the students with Optimization techniques and make them to solve life decision making problems based on deterministic and probabilistic models.

Unit 1: Introduction to OR - Linear programming problem - Formulation - Graphical method - Basic solution - Optimum solution - Simplex method - Various cases - Unbounded solution - Unrestricted variables, alternative optimum.

Unit 2: Need for artificial variables - Two phase method - Big M method - Primal, Dual relationship - Dual simplex method.

Unit 3: Transportation problem - Assignment problem - Traveling salesman problem - Transshipment problem.

Unit 4: Networks - Shortest route problem - Maximal flow - CPM and PERT - problems.

Unit 5: Decision under uncertainty - Laplace criterion - Minimax criterion - Savage criterion - Hurvitz theorem - Games - Two person zero sum games - Saddle point - Solving by graphical method - solving by LPP.

BOOKS FOR STUDY AND REFERENCE :

Don T. Philips, Ravindran, A, James J. Solberg (1976), Operations Research: Principles and Practices, John Wiley & sons.

Hadley (1962), Linear Programming, Addison - Wesley publishers.

Taha,H.A. (1987) Operations Research - An Introduction (fourth edition), Macmillan publishers.

Hillier, F.S, and Lieberman, G.J. (1974), Introduction to Operations Research, Holden Day Publishing, San Francisco.

Kanti Swarup, Gupta, P.K., Manmohan (1993), Operations Research, Sultan Chand Publishers.

Mittal, K.V. (1976), Optimization Methods in Operations Research, Wiley Eastern.

ST 6602 - STATISTICAL PROCESS CONTROL

SEMESTER : VI **CREDIT : 3**
CATEGORY : MS **NO. OF HRS / WEEK : 4**

Objective:

To provide an insight into quality assessment techniques.

Unit -1: Quality improvement in the modern business environment: Philosophy and basic concepts of quality improvement - Statistical methods for quality improvement - Total Quality Management (TQM).

Unit -2: Modeling process quality: Describing variation - Histogram, Stem and Leaf plot, Box plot, Frequency distributions, Quantile plot (qq-plot) applications.

Unit -3: Statistical Process Control (SPC): Methods and philosophy of SPC - Control charts for attributes data - p chart, np chart, c and u charts and D chart - Control charts for variables - X and R charts, X and S charts - Applications.

Unit -4: Basic principles of CUSUM and slant control charts - process capability analysis - Applications.

Unit -5: Acceptance sampling: The acceptance sampling problem - Single sampling plan for attributes with applications - Basic concepts of double, multiple and sequential sampling plans - Concept of CSP.

BOOKS FOR STUDY AND REFERENCE:

Duncan, A.J. (1974), Quality Control and Industrial Statistics (Fourth Edition), Irwin, Homewood, Ill.

Forrest Bray Fogel (1998), Six Sigma Limits

Grant, E.L. and Leavenworth, R.S. (1980), Statistical Quality Control (Fifth Edition), McGraw Hill, New York.

Montgomery, D.C. (1997), Introduction to Statistical Quality Control (Third Edition), John Wiley and sons Inc.

Schilling, E.G. (1982), Acceptance Sampling in Quality Control, Marcel Dekker Inc., N.Y.

ST 6650-A - STATISTICAL COMPUTING

SEMESTER : VI **CREDIT : 2**
CATEGORY : SK **NO. OF HRS / WEEK : 5**

Objective:

To enhance computing skills by analysing data using various statistical techniques

Unit -1: Industrial Statistics : Variable control charts - X bar, R and S charts. Attribute control charts - p, np, c and u charts. Acceptance sampling - OC curve, single and double sampling plans.

Unit -2: Operations Research : Linear programming problems - Simplex, Big M and Two-phase Methods. Transportation problems - NWCR, LCM and VAM for initial solution and U-V algorithm for optimum solution (both degenerate and non degeneration cases).

Unit -3: Assignment problems - Hungarian method - Network analysis - CPM and PERT.

Unit -4: Design of Experiments : One-way and two-way analysis of variance - CRD, RBD and LSD designs - Missing plot techniques.

Unit -5: Factorial designs - 2^2 and 2^3 designs - confounding in factorial experiments.

Note: An exposure to some statistical packages will be given.

List of exercises based on the above units has to be prepared by the concerned faculty

BOOKS FOR STUDY AND REFERENCE:

Das, M.N. and Giri N. (1979), Design and Analysis of Experiments, Wiley Eastern.

Montgomery,D.C. (1991), Design and Analysis of Experiments, John Wiley and sons.

Taha,H.A. (1987), Operations Research an Introduction (sixth edition), Prentice Hall of India private ltd.,

Kempthorne,O. (1967), Design and Analysis of Experiment, Wiley Eastern pvt. Ltd.

Vittal, B.R. (1999), Introduction to Operations Research, Margham publications.

SPSS, TORA and Minitab Software package.

ST 6650-B - STATISTICAL DATA ANALYSIS

SEMESTER : VI **CREDIT : 4**
CATEGORY : SK **NO. OF HRS / WEEK : 5**

Objective :

To orient the students to do the analysis of statistical data using statistical Packages.

Unit 1 : Essential terminology for all SPSS users- getting to SPSS for windows - the components of window - SPSS for windows screens - crucial preliminaries - entering data into SPSS - editing data - saving data file - retrieving data file.

Unit - 2 : Merging data files - adding scores to existing cases - add variables - running a simple analysis and obtaining the output.

Unit -3: Checking the data - Box plots of score distributions- listing of the data using case summaries - graphs - bar , line , pie chart, scatter plots and histograms.

Unit -4: Frequency distributions - measures of frequency distributions - cross tabulations - obtaining two sample chi-square tests - log-linear analysis - parametric statistical tests - comparing means - paired and unpaired t-tests.

Unit-5 : Correlation and multiple regression - analysing nominal and ordinal data - nonparametric analysis - Wilcoxon , Mann-Whitney and Kruskal Wallis tests - the concept of test reliability - assessing test reliabilty.

BOOKS FOR STUDY AND REFERENCE :

Clifford E.Lunneborg(2000). Data analysis by resampling: concepts and applications.Dusbury Thomson learning. Australia.

Everitt,B.S and Dunn,G(2001). Applied multivariate data analysis. Arnold London.

Jeremy J.Foster(2001). Data analysis using SPSS for windows. New edition. Versions 8-10.Sage publications. London.

Michael S.Louis - Beck(1995). Data analysis an introduction,Series: quantitative applications in the social sciences.Sage. publications. London.

ST 6650-C - ELEMENTS OF RELIABILITY THEORY

SEMESTER : VI **CREDIT : 4**
CATEGORY : SK **NO. OF HRS / WEEK : 5**

Objective:

To discuss several performance measures of systems in industries and related inference problems.

Unit -1: Basic concepts in reliability theory - failure time distribution , reliability , MTBF , hazard rate function , examples , IFR and DFR distributions. Reliability importance of exponential distribution.

Unit -2: Types of systems - series, parallel and standby systems of order 2.(k,n) Systems. Measures of system performance.

Unit -3: Systems with repair , parallel and standby systems of order 2 with a repair facility. Transient solution and measures of performance. Availability and Steady state availability.

Unit -4: Coherent systems - structure function , examples of coherent systems , properties - representation of coherent systems in terms of paths and cuts - reliability of systems of independent components.

Unit -5: Life testing - exponential distribution in life testing. Inference based on Type II censored sample.

BOOKS FOR STUDY AND REFERENCE:

Barlow, R.E and Proschan ,F.(1981).Statistical Theory of reliability and life testing. Holt, Rienhart and Winston Inc.New York.

Rau, J.G.(1970).Optimization and probability in systems engineering.Van Nostrand.

Ross,S.M.(1987),Introduction to probability and statistics for engineers and scientists. John Wiley and sons. New York.

Sinha,S.K(1986).Reliability and life testing. Wiley Eastern Ltd. New Delhi.

Zacks,S.(1993).Introduction to reliability analysis. Springer-Verlag. Germany.