DEPARTMENT OF STATISTICS

PG SYLLABUS

Effective from the Academic Year 2006-07

LOYOLA COLLEGE

Autonomous

College Conferred with Potential for Excellence by UGC

Accredited at A+ by NAAC

Chennai - 600 034

COURSE: M.Sc. (Statistics)

Sem	Cate	Code	Title of the Paper	HRS	Credits
I	MC	ST1808	Analysis	6	4
	MC	ST 1809	Measure and Probability	6	4
	MC	ST 1810	Advanced Distribution Theory	6	4
	MC	ST 1811	Applied Regression Analysis	6	4
	MC	ST 1812	Statistical Computing –I	4	3
II	MC	ST 2808	Estimation Theory	6	4
	MC	ST 2809	Testing Statistical Hypotheses	6	4
	MC	ST 2810	Sampling Theory	6	4
	SU	MT2902	Linear Algebra and Matrix theory	4	3
	ES		Elective I	5	3
III	MC	ST 3808	Multivariate Analysis	6	3
	MC	ST 3809	Stochastic Processes	6	4
	MC	ST 3810	Statistical Computing II	4	2
	SU	EU	Portfolio Management	4	3
	ID	ST 3875	Fuzzy theory and applications.	4	3
	EG	ST 3925	Common paper	4	3
IV	MC	ST 4805	Applied Experimental Designs	6	4
	MC	ST 4806	Statistical Process Control	6	4
	MC	ST 4807	Advanced Operations Research	6	4
	MC	ST4808	Statistical Computing III	4	2
	ES		Elective II/ Project	5	3
				Total	72

List of Supportive Papers

1. Linear Algebra & Matrix Theory from Mathematics Department
2. Portfolio Management / Economics from Economics Department

List of Elective Papers

1 Actuarial Statistics

2 Advanced Statistical Inference

3 Advanced Probability Theory

4 Biostatistics

5 C++ for Statistical Applications

BOOKS FOR REFERENCE

1. Ahlfors I.V.(1974).*Comples Analysis*, Mc Graw Hill.
2. Apostol T.M.(2000). *Mathematical Analysis*, Narosa Publishing House.
3. Moretti G.(1968). *Functions of a Complex Variable*, Prentice Hall of India Pvt Ltd.
4. Rudin W.(1983). *Principles of Mathematical Analysis*, Mc Graw Hill.
5. Rudin W.(1983). *Real and Complex Analysis*, Mc Graw Hill.

ST1809 : MEASURE AND PROBABILITY

Semester : I | Credits : 4
Category : MC | Hours/Week : 6

Objective : To imbibe advanced techniques in Measure Theory and Probability theory for Statistical applications

Unit 1: Classes of sets, sequence of sets, limit superior, limit inferior and limit of sequence of sets. Fields, sigma fields and monotone classes. Minimal sigma field over a class of sets, Borel field.

Unit 2: Measure on a sigma field. Measurable functions, simple function, sequence of measurable functions, Integral of a measurable function with respect to a measure, indefinite integral, basic integration theorems, Monotone convergence theorem, Fatou's lemma and Lebesgue dominated convergence theorem. Concepts of convergence in measure and Lp-convergence ,almost everywhere convergence and almost uniform convergence.

Radon – Nikodym theorem (statement only) and its applications. Product measures and Fubini's theorem(statement only).

Unit 3: Probabilty as a measure- Random vector ,distribution function, expectation, independence, characterisation of independence. Kolmogorov 0-1 law.

Integration in probability space- monotone convergence theorem, convergence of a sequence of random variables- convergence almost surely, in distribution, in probabilty, in mean square, their interrelationships.

Unit 4: Conditional expectation and conditional probability, inversion theorem, Levy continuity theorem, k-dimensional characteristic function.

Unit 5: Weak and strong laws of large numbers. Central limit theorems for independent random variables. Lindeberg-Levy, Liapunov and Lindeberg- Feller theorems.

BOOKS FOR STUDY AND REFERENCE

1. Ash, R.B. (1972). *Real Analysis and Probability*, Academic Press.
2. Bhat,B.R. (1985) Modern probability Theory,Wiley Eastern Ltd.
3. Billingsley,P.(1991). *Probability and Measure.* John Wiley & Sons, New York
4. Burril, C.W. (1972) . *Measure, Probability and Integration.* Mc Graw Hill, New York
5. Chow, Y.S. and Teicher, H.(1979). *Probability Theory.* Spring Verleg, New York
6. Kingman J.F.C and Taylor S.J.(1966). *Introduction to Measure and Probability*, Cambridge .University Press.
7. Loeve, M.(2000). *Probability Theory.*Van Nostrand, Princeton Munroe, M.E.(1971). *Introduction to Measure and Integration.*
8. Parthasarathy, K.R. (1977). *Introductin to Probability ans Measure.*Thmson Wadsworth
9. Tucker ,H,G. (1967) A graduate course in probability, John Wiley and Sons.

ST1810 : ADVANCED DISTRIBUTION THEORY

Semester : I | Credits : 4
Category : MC | Hours/Week : 6

Objective : To construct probability models applicable to real life situations

Unit 1: Discrete distributions : Uniform. Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, Power series. Continuous distributions : Uniform, Normal, Exponential, Gamma, Chi-square, t, F, Lognormal, Weibull, Cauchy, Beta, Inverse Gaussian. Characterisations of distributions : Geometric, Normal, Exponential. Truncated distributions : Binomial, Poisson, Normal.

Unit 2: Multivariate discrete distributions : Trinomial and Bivariate Poisson distribution, their properties, Multinomial and Multivariate Poisson distributions.

Unit 3: Multivariate continuous distributions : Bivariate normal and Bivariate exponential (Marshall and Olkin) distributions, properties, Multivariate extensions.

Unit 1: Fitting of distributions – Binomial, Poisson, Negative binomial, Normal, mixtures of binomial, mixtures of Poisson, mixtures of Poisson, mixtures of normal.

Goodness of fit tests

Unit 2: Fitting of orthogonal polynomials - Fitting of logistic curve by the method of selected points – Yules and Rodhes methods.

Drawing samples from normal, cauchy, pareto and truncated distributions.

Unit 3: Rank of a matrix Linear dependence and independence Linear equations

Characteristic roots and vectors Quadratic forms – rank, signature, reduction to canonical form. Quadratic forms in normal variables – independence of linear and quadratic forms, independence of two quadratic forms.

Unit 4: Simple regression – Regression diagnostics – Multiple regression – Non-Linear regression.

Unit 5: Logistic regression – Categorical data analysis.

ST2808: ESTIMATION THEORY

Semester	:	II	Credits	:	4
Category	:	MC	Hours/Week	:	6

Objective: To provide a strong theoretical foundation in Statistical Estimation Theory.

Unit 1: Problem of point estimation-unbiasedness-uniformly minimum variance unbiased estimator- necessary and sufficient condition for an estimator to be a UMVUE.Properties of UMVUE, Examples.

Unit 2: Sufficiency, Fisher-Neyman factorization theorem, likelihood equivalence, minimal sufficiency, examples. Completeness and bounded completeness. Basu's theorem.

Unit 3: Simultaneous unbiased estimator, loss and risk functions, uniformly minimum risk unbiased estimator, Joint and Marginal estimation, M-optimality, T-optimality, D-optimality,Q_A-optimality, their equivalence.

Convex loss function, Rao-Blackwell theorem, Lehmann-Scheffe theorem, examples. Cramer-Rao inequality for the multiparameter case.

Unit 4: Equivariant estimation, minimum risk equivariant estimator for location models, scale models and location-scale models. Illustrative examples.

Unit 5: Method of maximum likelihood, consistent asymptotic normal (CAN) estimators, examples. Invariance property of CAN estimators. Properties of likelihood equation estimators.

Baye's and minimax estimation, examples. M-estimation, Jack knife and Bootstrap methods.

BOOKS FOR STUDY AND REFERENCE:

1. Cramer,H.(1946).Mathematical methods of Statistics.Princeton University Press, N.J.
2. Dudewicz ,E.J and Misra,S.N.(1988),Modern Mathematical Statistics.John Wiley and Sons,N.Y.
3. Ferguson,T.S(1967).Mathematical Statistics – A decision theoretic approach.Academic Press.
4. Kale, B.K.(2005): A first course on parametric inference, Narosa Publishing House.
5. Kendall, M.G and Stuart,A.(1967).The Advanced Theory of Statistics. Vol.2. Inference and Relationship. Hafner Publishing Co., New York.
6. Lehmann,E.L.and Casella,G.(1998).Theory of point estimation. Springer-Verlag
7. Rao,C.R.(1973).Linear Statistical inference and its applications. Wiley Eastern Ltd.
8. Rohatgi,V.K. and Saleh A.K.Md.E.,(2002).An Introduction to Probability and Statistics. John Wiley and Sons,N.Y.
9. Zacks, S. (1971). The theory of Statistical inference. John Wiley and Sons,N.Y.

ST 2809 : TESTING STATISTICAL HYPOTHESES

Semester	:	II	Credits	:	4
Category	:	MC	Hours/Week	:	6

Objective: 1) To impart knowledge on statistical modeling for decision support based on sample characteristics.

Unit 1 Elements of statistical decision theory, Statistical hypotheses, Neyman – Pearson fundamental lemma, distributions with monotone

ST 3808 MULTIVARIATE ANALYSIS

Semester : III | Credits : 3
Category : MC | Hours/Week : 6

Objective : *To train the students to acquire theoretical background of multivariate statistical tools and apply them in real life situations*

Unit 1 Matrix Algebra and Random Matrix: Basics of Matrix and Vector Algebra –Positive Definite Matrices – Square Root Matrix – Random vectors and Matrices – Mean vectors and Covariance Matrices – Matrix Inequalities and Maximization

Sample Geometry and Random Sampling : Geometry of the sample – Random samples and the expected values of the sample mean and covariance matrix – Generalized variance

Unit 2 Multivariate Normal Density and Its Properties – Sampling from a multivariate normal distribution and Maximum Likelihood Estimation – Sampling Distribution of and S – Assessing the assumption of normality

Unit 3 Inference about mean vector : Hotelling's and likelihood ratio tests – Comparing single population mean vectors from two populations – One way and two way Manova

Unit 4 Principal Component Analysis – Population Principal Components – Summarizing Sample variation by Principal Components Factor Analysis – Orthogonal Factor Model – Methods of Estimation – Factor rotation

Unit 5 Classification Problems - Seperation and classification for two populations – General Classification Problem – Optimal classification rules for two populations – classification with two multivariate normal populations

Cluster Analysis : Similarity measures – Hierarchical Clustering Methods – Nonhierarchical Clustering Methods

BOOKS FOR STUDY AND REFERENCE :

1. Anderson,T.W. (2002) An Introduction to Multivariate Statistical Analysis. John Wiley & sons, NY
2. Johnson,R.A. and Wichern, D.W. Prentice (1988): Applied Multivariate Statistical Analysis. Prentice Hall International, Inc.

ST 3809: STOCHASTIC PROCESSES

Semester : III | Credits : 4
Category : MC | Hours/Week : 6

Objectives:

i. To introduce basic concepts in Stochastic Processes.

ii. To expose several processes in disciplines like Biology, Engineering and Economics.

Unit 1 Elements of Stochastic processes – simple examples, Classification of general stochastic processes. Stationary independent increment process. Properties.

Unit 2 Markov Chains – discrete in time. Examples. Classification of states of a Markov Chain. Recurrence. Basic limit theorem of Markov Chains. Absorption probabilities. Criteria for recurrence.

Unit 3 Markov Chains continuous in time. Examples. General Pure birth process, Poisson process, Birth – Death process. Finite state continuous time Markov Chains. Bivariate Poisson process.

Unit 4 Renewal process – Definition and examples, Elementary Renewal Theorem, Martingales – Examples. Super and Sub - martingales.

Unit 5 Branching process – generating function relations, estimation probabilities, two – type branching process – Description of continuous time branching process. Stationary process – mean square distance, prediction and covariance stationary process.

BOOKS FOR STUDY AND REFERENCE.

1. Bartholomew(1973). Stochastic models for Social processes. John Wiley and Sons Ltd, London.
2. Cinlar, E(1975). Introduction to Stochastic Processes. Prentice – Hall, Inc. New Jersey.
3. Cox, D.R. and Miller, H.D.(1965). Theory of Stochastic Processes – Chapman and Hall, London 3rd edition
4. Doob, J(1953). Stochastic Processes, John Wiley and Sons, New York.
5. Feller, W(1972). An introduction to probability theory and its applications, Vol.I, Wiley Eastern Ltd.

2. Klir, G.J. and Yuan, B. (1997): Fuzzy sets and Fuzzy logic-Theory and applications, Prentice Hall of India, New Delhi.
3. Lee, K.H. (2005): First course on Fuzzy theory and applications, Springer-Verlag, London.
4. Zimmermann, H.J. (1996): Fuzzy set theory and its applications, Kluwer Academic Publications, London.

ST 4805 : APPLIED EXPERIMENTAL DESIGNS

Semester : IV | Credits : 4
Category : MC | Hours / week : 6

Objectives: To provide both basic and advanced experimental designs applied in Agriculture, Pharmaceutical, Industrial and Biological sciences.

Unit 1 Review of Linear models – Block Design, C-matrix and its properties- Analysis of block design – (CRD) completely Randomized design – (RBD)- Randomized Block Design – (LSD)- Latin Square Design –(RLSD) Repeated Latin Square Design – Missing plot techniques.

Unit 2 Factorial Design – 2^n; 3^n factorial designs. Finite fields and design of experiments. Partial confounding and complete confounding – confounding in more than two blocks. Fractional factorials – construction and analysis-concept of resolution plans.

Unit 3 Asymmetrical factorial designs (AFD)- AFD- confounded asymmetrical factorial design construction of balanced confounded asymmetrical factorials-split and strip-plot experiment.

Unit 4 Incomplete block designs – varietal Trials – incomplete block design balanced incomplete block designs (BIBD) construction of BIBD – analysis of BIBD, Youden square design – Lattice designs. Partially balanced incomplete block design (PBIBD) – analysis and construction of PBIBD.

Unit 5 Orthogonal Latin square – maximum number of orthogonal Latin squares – construction of orthogonal Latin squares – construction of BIBD using orthogonal Latin squares. Response surface designs- definition of response surface design – first order and second order response surface design.

BOOKS FOR STUDY AND REFERENCE:

1. Chakrabarthi, M.C. (1970). Mathematics of design and analysis of experiments. Asia Publishing House
2. Dey, A. (1986). Theory of Block Designs, wiley Eastern.
3. Das, M.N. and Giri,N. (1988). Design and Analysis of Experiments, Wiley Eastern.
4. Ferderer, W.T. (1993). Experimental Designs – Theory and Applications, McMillan.
5. Joshi,D.D (1987). Linear estimation and design of experiments. Wiley Eastern.
6. Kempthorne, O. (2000). Design and Analysis of Experiments, Wiley Eastern.
7. Montgomery, D.C.(2003) Design and Analysis of Experiments, John Wiley & Sons.

ST 4806:STATISTICAL PROCESS CONTROL

Semester : IV | Credits : 4
Category : MC | Hours/week : 6

Objective : To train students in modern statistical process control techniques.

Unit 1 Meaning and Scope of Statistical process control (spc), Shewart Control Charts for X-bar , R, np, p, c charts. and their uses. OC and ARL of control charts. Uses of runs and related patterns of points.

Unit 2 control charts based on C.V. extreme values, moving averages, geometric moving averages, modified control charts CUSUM procedures, use of V mask, derivation of ARL. Multivariate control charts.

Unit 3 Process capability, tolerance limits, beta content and beta expectation, Normal theory and non-parametric approaches.

Unit 4 Sampling inspection plans. Classification and general properties Sampling plans by variables, estimation of lot defective and plan parameter determination in known and unknown cases.

Continuous sampling plans – CSP- 1 and its modifications. Derivation of AOQL for CSP-1, operations of MLP's and Wald-Wolfowitz plans.

Unit 5 Implementing six sigma. Six sigma overview and implementations- smarter six sigma solutions(S^4) measurements :

Unit 5 Integer programming problems-Dynamic programming problems-Non-Linear programming problems-Stochastic programming problems.

ST 2952 :SAS PROGRAMMING FOR STATISTICAL APPLICATIONS

Semester	: II	Credits	: 3
Category	: ES	Hrs./week	: 5

Objective: To explore the fundamental programming logic in SAS so as to facilitate the ease of Statistical data analytical capabilities ,

Unit 1. Introduction to SAS: An overview of the SAS system – Components of SAS programs – Introduction to SAS programs: Fundamental concepts – SAS datasets – Naming datasets and variables – CONTENTS and PRINT procedures- Running SAS programs - Diagnosing and Correcting syntax errors – Exploring SAS libraries and files: Creating and maintaining temporary and permanent SAS libraries. Producing list report – Sub-setting – SAS comparison , logical and special operators – Enhancing output – Formatting Data Values – Creating user-defined FORMATs – Creating HTML reports

Unit 2 . Creating and Manipulating SAS Data sets: Reading raw data files - Examining Data errors and log errors – Assigning attributes to variables – Integration with Excel spreadsheets – Reading SAS data sets and Creating variables – Conditional processing – Dropping and Keeping variables – Concatenating , Merging and Combining SAS data sets(one-to-one, one-to-many, many-to-many) - Match-Merging SAS data sets - simple Joins using the SQL procedure.

Unit 3. Data Transformations: Manipulating Character, Numeric, Numeric-Date values – Converting variable type. Iterative Data processing: DO loop and SAS ARRAY processing. Summary reports ,Graphics charts and Plots: Producing Summary reports using FREQ, MEANS, REPORT and TABULATE procedures – Producing Graphics charts (Bar, Pie ets) using GCHART procedure – Enhancing charts – Producing Plots using GPLOT statement.

Unit 4. Descriptive Statistics and ANOVA: Selecting Random samples from SAS datasets - Performing Descriptive statistical analysis , Examining distributions , Estimating Confidence intervals for mean and Hypothesis testing of single Mean - Two-Sample t-Tests using UNIVARIATE procedure – Paired t-Tests – One-Way ANOVA, Two-Way ANOVA with/ without interactions using GLM procedure – Multiple comparison tests - Non-Parametric ANOVA.

Unit 5. Exploratory Data Analysis: Simple, Partial and Multiple correlation – Simple Linear Regression – Multiple Regression – Model building and Interpretation – Regression Diagnostics: Examining Residuals, identifying and handling influential observations – Collinearity. Categorical Data Analysis: Tests of Association – Simple Logistic Regression – Multiple Logistic Regression – Logit Plots and Interaction Plots.

BOOKS FOR STUDY AND REFERENCE:

1. Norm O'Rourke, Larry Hatcher, and Edward Stepanski (2005).A Step-by-Step Approach to Using SAS for Univariate and Multivariate Statistics, Second Edition, SAS Press and John Wiley Sons Inc.
2. SAS programming I, SAS programming II, SAS-STAT programming by SAS Instititute(2005).
3. www.sas.com/pubs (for online bookstore)

ST2953: ACTUARIAL STATISTICS

Semester	: III	Credits	: 3
Category	: ES	Hours/Week	: 5

Objective: To educate the students about the applications of statistics in insurance industry.

Unit 1 Compound Interest-Accumulated value and present value annuities certain, present values, amounts, annuities, perpetuities, Redemption of loans.

Unit 2 Further compound interest and Annuities certain, Nominal and effective rates of discount – capital redemption of policies

Unit 3 Mortality tables – construction of mortality tables comparison of different mortality tables.

ST3954 :DATA WAREHOUSING AND DATA MINING

Semester	:	III	Credits	:	3
Category	:	ES	Hours/Week	:	5

Objective: To recourse knowledge discovery through database which leads to Business Intelligence.

Unit 1 Data Warehouse Basics: Definition of a Data Warehouse - Basic Elements of the Data Warehouse - Data Warehouse and OLTP Database Design, Differences - Data Warehouse Features - Manage Data, Decision Support System (DSS) - Data Warehousing Process - Comparing Warehouses and Data Marts - Dependent Data Mart Model - Independent Data Mart Model - Enterprise Model Architecture.

Unit 2 Defining the Business and Logical Models: Documenting Business Measures and Documenting Business Dimensions Creating the Metadata -Designing the Dimensional Model: Data Warehouse Database Design Objectives - Data Warehouse Data Types - Star Dimensional Modeling - Fact Tables - Dimension Tables - Translating Business Dimensions into Dimension- Star Dimensional Model Characteristics - Snowflake Model - Constellation Configuration-Designing the Physical Model - Translating the Dimensional Model into a Physical Model.-Storage Considerations for the Physical Model- Database Sizing - Estimating the Database Size - Indexing Types - B*tree Index, Bitmap Indexes - Partitioning Tables and Indexes - Methods of Partitioning - Vertical Partitioning, Range Partitioning - Hash Partitioning .

Unit 3 Strategies for Extracting, Transforming, and Transporting: Extraction – Transformation - and Transportation Process (ETT) - Data Staging Area - Extracting Data , -Examining Source Systems – Mapping - Designing Extraction Processes - Transformation Techniques - Designing Transformation Processes - ETT Tools and Gateways-Summary Management: Managing Historical Summary Data in the Warehouse— Statistical measures in large databases. Data cleaning – Importance of Data Quality, Data integration and transformation - Data mining primitives- Data Mining Query Language.

Unit 4 Classification and Prediction: Issues – Decision tree induction – Bayesian classification - classification by back Propagation – classification based on association rule – Other methods of classification – Prediction – Accuracy of classifiers Cluster Analysis: Definition – Types of data in cluster analysis - Partitioning methods – Hierarchical methods – Density based methods – Grid based methods – Model based methods.

Unit 5 Analytical Capabilities: Business Intelligence - Categories of Business Intelligence Tools - Query Tools - Multidimensional Query Techniques - Data Mining Tools - OLAP Tools - OLAP Storage – OLAP – ROLAP – MOLAP –HOLAP-Mining complex data types: Mining of Complex data objects - Mining of spatial data bases – Mining multimedia databases – Mining time-series data – Mining text databases - Mining World Wide Web-. Trends in Data Mining.

BOOKS FOR STUDY AND REFERENCE

1. Anahory S, Murray D(2001) Data Warehousing In The Real World: Practical Guide For Building Decision Support Systems, Addison Wesley.
2. Han J and Kamber M (2002) , Data Mining concepts and Techniques, Morgan Kaufmann Publishers (Only relevant sections), SRI ESWAR ENTERPRISES
3. Pieter Adriaans and Dolf Zantinge (2000), Data Mining, Addison Wesley.
4. Pujari A..K (2001) Data Mining Techniques, University Press, Hyderabad.

ST4955: RELIABILITY THEORY

Semester	:	IV	Credits	:	3
Category	:	ES	Hours/week	:	5

Objectives:

i. To provide basic ideas of Coherent systems with real life applications.

ii. To expose the analysis of specific systems with repair facilities.

Unit 1 Coherent systems: cuts and paths, Modular decomposition, Reliability of Coherent systems, bounds on system reliability.

Unit 2 Life distributions: survival function,hazard rate, hazard function, Residual lifetime, mean residual life function, one-one correspondence of these functions,Common life distributions, exponenrial , gamma,Weibull,lognormal.

ST 3902: STATISTICS FOR ECONOMISTS

Semester	:	III	Credits	:	3
Category	:	SU	Hrs/Week	:	4

Objectives:

i. To provide a strong foundation for more professional training in statistics and operations research.

ii. To provide statistical applications using excel and tora computer software in the analysis of economic problem

Unit 1 Measures of Location and Dispersion – Moments – Skew ness – Kurtosis – Karl Pearson's correlation coefficient – Spearman's rank correlation coefficient – Linear Regression.

Unit 2 Probability – Sample spaces, Different approaches to Definition of probability – Addition and Multiplication Laws – Mutually Exclusive and independent events – Conditional probability – Baye's theorem (statement and problems only) Random variables – Distribution function – probability mass function – density function.

Binomial, Poisson and Normal distributions – Central limit theorem (statement of Lindeberg - Levy form).

Unit 3 Tests of significance Null and alternative hypothesis, Types of errors – small sample tests for mean and proportions of normal populations – equality of means and two normal populations – Large sample tests for proportions and equality of proportions – Chi-square tests for independence of attributes and goodness of fit.

Unit 4 Time Series – Components of Time Series – Measurement of Trend and Seasonal Variations – Index Numbers – Laspeyre's, Paasche's and Fisher's Ideal Index Number – Cost of Living index and wholesale price index numbers.

Unit 5 Linear Programming – Formulation of problems – Graphical solution. Transportation problems – North-West corner rule, Least cost and Vogel's approximation method – Determination of optimal solutions. Assignment problems – Obtaining initial and optimal solutions.

BOOKS FOR STUDY AND REFERENCE:

1. Freund, J. E., Mathematical Statistics (1992) Prentice Hall, New Delhi
2. Gupta S.P., Statistical Methods (1997) Sultan and Chand and Sons Pvt Ltd., New Delhi
3. Gupta S.C. and V.K. Kapoor., (1997) Fundamentals of Applied Statistics Sultan Chand and Sons Pvt. Ltd., New Delhi.
4. Swarup, Kanti, P.K. Gupta and Man Mohan., (1996) Operations Research,
5. Sultan Chand & Sons, New Delhi
6. Taha, H. A., Operations Research: An Introduction (1997) Macmillan Publishing Housing Co., New York.

ST 3901: STATISTICAL APPLICATIONS IN BIOLOGICAL SCIENCESS

Semester	:	III	Credits	:	3
Category	:	SU	Hrs/Week	:	4

Objectives:

i. To imbibe statistical techniques applicable in biological / environmental Sciences.

ii. To demonstrate the statistical methods using MS Excel.

Unit 1 Descriptive statistics-Diagrammatic representation measures of location, measures of dispersion, skewness and kurtosis.

Unit 2 Correlation and regression – Bivariate frequency table – rank correlation – multiple regression.

Unit 3 Statistical inference – point and interval estimation, hypothesis testing, test for assigned proportion, equality of proportions, assigned mean, equality of means.

Unit 4 Chi-square test for goodness of fit, contingency table, test for independence of two attributes.

Unit 5 Analysis of variance – one – way classification, two-way classification.

Note: Emphasis will be on concepts and applications to biological data.