

Annexure No.	19 A
SCAA Dated	29.02.2008

BHARATHIAR UNIVERSITY : COIMBATORE-641 046
SUBJECTS OFFERED FOR BRANCH-II A :: M. Sc. STATISTICS (CBCS)
with Compulsory Diploma in Actuarial Science
(with effect from 2007-08 onwards)
Details of Core/Elective/Supportive Subjects offered

CORE Subjects:

1. Probability and Distributions
2. Statistical Quality Control
3. Sampling Theory and Methods
4. Multivariate Analysis
5. Statistical Inference
6. Statistical Practical - I
7. Linear Models and Design of Experiments
8. Operations Research
9. Econometrics
10. Time Series and Stochastic Processes
11. Statistical Practical - II
12. Application of Statistical Software Packages
13. Project & VIVA-VOCE

ELECTIVE Subjects (to be offered to our Department students)

1. Problem Solving and Programming in 'C'
2. Object Oriented Programming with C++
3. Visual Basic and Computer Graphics

ELECTIVE Subjects (to be offered to other Department students)

1. Probability and Statistics
2. Statistics for Management
3. Bio-Statistics
4. Operations Research Methods
5. Actuarial Statistics

SUPPORTIVE Subjects (to be offered to other Department students)

1. Descriptive Statistics
2. Statistical Methods for Researchers
3. Statistical Methods for Industries
4. Data Analysis
5. Statistical Methods for Biologists
6. Elements of Operations Research

Papers Offered for Diploma Course (PG Diploma in Actuarial Science)

1. Financial Mathematics
2. Principles of Insurance
3. Actuarial Mathematics
4. Practice of Life Assurance

CONTINUOUS INTERNAL ASSESSMENT

Theory Papers: Maximum 40% The sessional Assessments may be in the form of Combination of Periodical tests, Assignments and Seminar. The Assessment Procedure to be followed for each Course shall be approved by the Programme Committee.

Details of the Subjects offered and Scheme of examinations

Semester – I					
Subject Code	Title of the papers	Credit Point	Int	Ext	Total Marks
01STABC01	Probability and Distributions	4	40	60	100
01STABC02	Statistical Quality Control	4	40	60	100
01STABC03	Sampling Theory and Methods	4	40	60	100
04STAGE21 (Elective)	Problem Solving and Programming in 'C'	4	40	60	100
Supportive	Offered in other Departments	2	20	30	50
07STABD31	Diploma-Paper I-Financial Mathematics	4	40	60	100
		Total	18+4		550
Semester – II					
01STABC04	Multivariate Analysis	4	40	60	100
01STABC05	Statistical Inference	4	40	60	100
01STABC06	Statistical Practical – I	4	40	60	100
04STAGE22 (Elective)	Object Oriented Programming with C++	4	40	60	100
Supportive	Offered in other Departments	2	20	30	50
07STABD32	Diploma-Paper II-Principles of Insurance	4	40	60	100
		Total	18+4		550
Semester – III					
01STABC07	Linear Models and Design of Experiments	4	40	60	100
01STABC08	Operations Research	4	40	60	100
01STABC09	Econometrics	4	40	60	100
04STAGE23 (Elective)	Visual Basic and Computer Graphics	4	40	60	100
Supportive	Offered in other Departments	2	20	30	50
07STABD33	Diploma-Paper III-Actuarial Mathematics	4	40	60	100
		Total	18+4		550
Semester – IV					
01STABC10	Time Series and Stochastic Processes	4	40	60	100
07STABC25	Application of Statistical Software Packages	3	25	50	75
01STABC11	Statistical Practical – II	3	25	50	75
01STABP12	* Project and viva-voce	8			200
07STABD34	Diploma-Paper IV-Practice of Life Assurance	4	40	60	100
		Total	18+4		550

TOTAL MARKS: 1800 + 400

TOTAL CREDITS:72 + 16

*Internal Assessment (30%)+Evaluation of Project (40%)+Project viva-voce (30%)

$$60 + 80 + 60 = 200$$

SEMESTER – I

AIMS:

1. To provide a broad based high quality education with combination of the subjects like Probability and Distributions, Statistical Quality Control, Sampling Theory and Methods, Problem Solving and Programming in C and Financial Mathematics to Post-Graduate Degree level for students who have to demonstrate that they have the ability and potential towards Statistical Theory and Applications.
2. To develop knowledge, understanding and experience of the theory, practice and application of selected areas of Statistical computing and to produce graduates needed by public and private sector to help and solve practical problems using the skills and techniques of these areas, developing analytical skill for Insurance Sector.
- 3.To develop enterprise competences emphasizing the key skills of learning and communication for Statistical theory.

OBJECTIVES:

- 1.An understanding of the Statistical principles, techniques and applications of selected areas of Statistics and computing.
- 2.The ability to evaluate, select, write and use of computer software packages for Statistical theory, which takes into, account the needs of the user and constraints towards computing environment.
- 3.The ability and confidence to analyze and solve problems both of a routine and of obvious nature towards applications of Statistical theory.
- 4.To have gained deeper understanding, problem solving skills and greater knowledge of selected topics in statistical computation.

01STABC01

CORE - 1

PROBABILITY AND DISTRIBUTIONS

UNIT-I

Probability Spaces and Distribution in R^n , Expectations and Moments, Basic, Markov, Chebyshev's, Holders, Minkowski and Jensen's Inequalities. Independence of events and random Variables, Multiplication Property.

UNIT-II

Convergence of random variables, Convergence in Probability, Almost sure in the r^{th} mean and in distribution, their relationships, convergence of moments, Helly-Bray theorem.

Convergence of series of random variables, Kolmogorov's three series theorem, Glivenko-Cantelli theorem.

UNIT-III

Characteristic functions, its properties, Inversion theorem, Continuity theorem and its applications.

UNIT-IV

Kinchine's Weak Law of Large Numbers, Strong Law of Large Numbers. Central Limit Theorem - Statement of CLT, Lindeberg and Levy and Liapounov forms with proof and Lindeberg-Feller's form without proof and examples.

UNIT-V

Review of Sampling Distributions, Non-central t, F and Chi-Square Distributions and their properties. Order Statistics, their distributions and properties.

Books for Study:

1. Rohatgi V.K. (2002) : **Introduction to Mathematical Statistics**, Wiley.
2. Bhat, B. R. (1984) : **Modern Probability Theory – An Introductory Text Book**, Second Edition, Wiley Eastern.

Books for Reference :

1. Feller, W. (1972) : **Introduction to Probability Theory and its Applications**, Vol. II, Second Edition, Wiley Eastern.
2. Rao, C.R. (1973): **Linear Statistical Inference**, Second Edition, Wiley Eastern.
3. Johnson and Kotz (1972): **Distributions in Statistics**, Princeton University Press.

01STABC02

CORE - 2

STATISTICAL QUALITY CONTROL

UNIT-I

Shewhart Control Charts for \bar{X} , R, np, p, c etc., and their uses, OC and ARL of Control Charts, Control Charts based on C.V., Modified Control Charts, CUSUM procedures, use of V-mask, Derivation of ARL.

UNIT-II

Decision Interval Schemes for CUSUM charts. Economic Designs of Control Charts, Pre-control, Relative Precision and Process Capability analysis and Gauge capability analysis, Multivariate Control charts χ^2 and Hotelling T^2 .

UNIT-III

Basic Concepts of Acceptance Sampling, Single, Double, Multiple and Sequential Sampling Plans for Attributes, Curtailed and Semi Curtailed Sampling. Dodge-Romig Tables-LTPD and AOQL protection (Single Sampling Plan only). MIL-STD-105D.

UNIT-IV

Variable Sampling: Assumptions, Single and Double Variable Sampling Plans. Application of Normal and Non-central t-Distributions in Variable Sampling. Continuous Sampling Plans: CSP-1, CSP-2 and CSP-3. Special Purpose Plans: Chain Sampling Plans, Skip-lot Plans.

UNIT-V

Concept : Hazard Function and Reliability Function. Exponential, Gamma and Weibull Failure Models. Models for wearout failures. System Reliability-Serial, parallel and mixed systems.

Books for Study:

1. Montgomery, D.C., (1985): **Introduction to Quality Control** John Wiley.
2. Schilling, E.G. (1982): **Acceptance Sampling in Quality Control**, Marcel Dekker.
3. Burr, I.W., (1976): **Statistical Quality Control Methods**, Marcel Dekker.
4. H.J. Mittag and H. Rinne (1993): **Statistical Methods of Quality Assurance**, Germany Chapman & Hall India (UK) – Chapter 3 and 4.

Books for Reference:

1. Whetherill, G.B., (1977): **Sampling Inspection and Quality Control**, Halsted Press, New York.
2. Freeman, H.A., Friedman, M. and Others (1948). **Sampling Inspection Principles- Procedures and Tables for Single, Double and sequential Plans in Acceptance Quality Control**, McGraw Hill.
3. Hald, A. (1981): **Statistical theory of Sampling by Attributes**, Academic Press.
4. Ott, E.R., (1975): **Process Quality Control**, McGraw Hill.
5. Halpern, S (1979): **An Introduction to Quality Control and Reliability**, Prentice Hall of India.
6. Lawless J.R. (1982) : **Statistical Methods for Lifetime Data**, John Wiley & Sons.

01STABC03

CORE - 3

SAMPLING THEORY AND METHODS

UNIT-I

Concept of Sampling Design, Sampling Scheme and Sampling Strategy, Estimator of Population mean in SRS with replacement. Systematic sampling - Variance of Estimated mean, Populations in Random order, population with Linear and Period Trend, Auto-Correlated Populations.

UNIT-II

Des Raj method of Estimation, Murthy's Unordering Principle, Sampling Strategy due to Rao-Hartley and Cochran, Hartley-Ross Estimator, Midzuno Scheme of Sampling, PPS Sampling Procedures.

Cluster Sampling-Single Cluster Sampling-Cluster of Equal and Unequal sizes, Two Stage Cluster Sampling; Mean, Variance, Variance of the Estimated Mean.

UNIT-III

Ratio Estimates-Methods of Estimation, Approximate Variance of Ratio Estimates, Bias of the Ratio Estimates, Conditions under which the Ratio Estimate is Optimum, Unbiased Ratio-Type Estimates.

Regression Estimates-Linear Regression Estimates, Regression estimated when computed from sample, Accuracy of the Variance of Regression Estimates.

UNIT-IV

Double sampling Procedures and repeated surveys, Double Sampling for Stratification and Optimum Allocation, Regression Estimates-Estimated Variance for Stratification and Regression Ratio Estimates-Repeated Samplings-Sampling on two occasions, Sampling on more than two occasions.

UNIT-V

Errors in Surveys-Non Response, types of Non-Response, Call -Backs, a mathematical model of the effects of Call-Backs adjustment for basis without Call-backs, Mathematical Model for Errors of Measurement, Interpenetrating sub sample.

Books for Study:

1. Cochran, W.G.(1972): **Sampling Techniques**, Wiley Eastern Private Limited.
2. Sukhatme, P.V. and Sukhatme, B.V.(1977): **Sampling Theory of Survey with Applications**, Asia publishing House.

Books for Reference:

1. Des Raj (1976): **Sampling Theory**, Tata-Mcgraw Hill.
2. Sampath.S (2000) : **Sampling Theory and Methods**, Narosa publishing company, New Delhi.
3. Murthy, M.N. (1967): **Sampling theory and Methods**, Statistical Publishing Society, Calcutta.

04STAGE21

ELECTIVE - 1

PROBLEM SOLVING AND PROGRAMMING IN C

UNIT-I

Over – view of C : - Introduction to C – Importance of C – sample C programs – basic structure of C programs - programming style - Executing a C program - constants, variables and data types: Character set - C tokens - keywords and Identifiers – constants - variables – Data types - Declaration of a variables – assigning values to variables - Defining symbolic constants.

UNIT-II

Operations and Expressions:- Arithmetic operators – Relational operators - Logical operator – Assignment operators – Conditional Operators – Library Functions.

UNIT-III

Managing Input and Output operators:- Single character input get char function - put char function – scanf function – more about the scanf function - writing output data – printf function – more about the print function gets and puts function.

UNIT-IV

Decision Making and Branching:- Decision making with IF statement, simple IF statement – IF..ELSE statement – Nesting of IF...ELSE statements - Switch statement –

Break statement - Continue statement – Comma operator – Go to statement - While statement – Do .. While statement - For statement–Arrays – applications of Arrays.

UNIT–V

Defining a function – Accessing a function – passing arguments to a function – Storage classes – Automatic variables – External variable – Static variable – Pointer declarations – pointer and its applications – defining a structure - processing a structure.

Boos for Study:

1. E.Balagurusamy, **Programming in ANSI ‘C’** Tata McGraw Hill publishing company, 1998. Unit – I, II, III, IV & V
2. Byron S. Gottfried **Schaum’s Outline series theory and problems of programming with ‘C’** McGraw Hill publishing company 1997. Unit –III, IV & V.

Books for Reference :

1. **C – The Complete Reference - 3rd Ed.** – Herbert Schildt – McGraw Hill.
2. Yashwant Kanetkar – **Let us C**, BPB Publications, New Delhi.
3. Jean Paul Tremblay: Richard Bunt – **Introduction to Computer science – Algorithmic Approach** - McGraw Hill.
4. Mullish, Cooper : **The Sprit of C – An Introduction of Modern Programming** – Jaico Publishing House.

SEMESTER – II

AIMS:

1. To provide a broad based high quality education with combination of the subjects like Multivariate Analysis, Statistical Inference, Object Oriented Programming with C++ and Principles of Insurance to Post-Graduate Degree level for students who have to demonstrate that they have the ability and potential towards Statistical Theory and Applications.
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CORE - 4

MULTIVARIATE ANALYSIS

UNIT-I

Reviews of Multivariate Distributions, Multiple and Partial Correlation and Regression, Multivariate Normal Distribution, Marginal and Conditional Distributions.

UNIT-II

Maximum likelihood Estimators of Parameters, Distribution of Sample Mean Vector, and Sample Dispersion Matrix, James-Stein Estimator for the Mean Vector, Wishart Distribution and its Properties (without derivation), Maximum Correlations and their Null Distributions. Tests based on total, partial and multiple Correlations.

UNIT-III

Tests on Mean Vectors for one and two Multivariate Normal Distributions, Hotelling's T^2 and Mahalanobis D^2 Distributions, Related Confidence Regions. Testing and Illustration using likelihood Ratio Criterion.

UNIT-IV

Principal Component Analysis, Factor Analysis Underlying Models and Illustrations, Identification Problem, Estimation - Maximum likelihood Method, Centroid Method, Principal Factor Analysis, Estimating Factor/Score, Testing goodness of fit, Rotation of Factors.

UNIT-V

Classification Analysis using Discriminant Function Hierarchical Clustering: (a) Agglomerative techniques, Single Linkage Method, Complete Linkage Method, Incremental Sum of Squares Method, Median Method, Group Average Methods, Comparison of Methods, Divisive techniques - Monothetic Methods, Polythetic Methods.

Books for Study:

1. Anderson, T.W. (1980): **An Introduction to Multivariate Statistical Analysis**, Second Edition, Wiley Eastern.
2. M.Jambu and Lebeaux, M.O.(1983): **Cluster Analysis and Data Analysis**, North-Holland Publishing Company.

Books for Reference:

1. Kshirsagar, A.M. (1972): **Multivariate Analysis**, Marcel Decker.
2. Morrison, D.F.(1976): **Multivariate Statistical Methods**, Second Edition, McGraw Hill.
3. Afifi, A.A. and Azen, S.P. (1979): **Statistical Analysis - A Computer Oriented Approach**, Academic Press.

01STABC05

CORE - 5

STATISTICAL INFERENCE

UNIT-I

Point and Interval Estimation. Invariance, Exponential Family, Location and Scale Family, UMVU Estimation, Rao-Blackwell Theorem, Completeness, Fisher Information, Cramer-Rao Inequality and its generalization.

UNIT-II

Methods of Estimation (one or more parameters). Method of Moments, Minimum Chi-Square, Least Squares, Maximum Likelihood Estimator (MLE) and their properties.

UNIT-III

Basic Concepts of Testing, Randomized Tests, Neyman-Pearson Lemma, Most powerful Test (MPT) and Uniformly Most Powerful test (UMPT), Monotone Likelihood Ratio, Generalized Neyman-Pearson Lemma.

UNIT-IV

Boundedly Complete Statistics, Similar Regions, Likelihood Ratio Test (LRT), Large Sample Properties, Consistency of test Asymptotic Distribution of LRT.

UNIT-V

Chi-Square goodness of fit test and its Asymptotic Distribution. Kolmogorov test, Sign Test and its optimality, Wilcoxon Signed Rank Test, Mood's test, Test for Randomness, Run Test. Kolmogorov Smirnov Test, Wilcoxon-Mann Whitney Test, Median Test.

Books for Study:

1. Rohatgi, V. K.,(1984): **An Introduction to Probability Theory and Mathematical Statistics**, Wiley Eastern.
2. Mood, A.M. Graybill,F.A. and Boes,D.C. (1974): **Introduction to the Theory of Statistics**, McGraw Hill, Inc.

Books for Reference:

1. Rao, C.R. (1973): **Linear Statistical Inference and its Applications**, Wiley Eastern.
2. Lehman, E.L.(1959):**Testing Statistical Hypothesis**, John Wiley and Sons, Inc., New York.
3. Gibbons, J.D. (1985): **Non-Parametric Methods in Statistics**, 2nd Edition, Marcel Dekkar.

01STABC06

CORE – 6

STATISTICAL PRACTICAL – I

The Maximum Mark is 100 with 40 Marks for Internal involving Test and Record work. 60 Marks for End Examination. The candidate should attend 3 questions out of 4 questions each with 20 Marks with Internal choice. Problem relating to the areas listed below covered under Semester I and Semester II. The Core Practical-I examination is to be conducted at the end of the II Semester. The list of topics included for practical are given below,

1. STATISTICAL QUALITY CONTROL:

Control Charts for \bar{X} , R, p, np, c and u charts – Single Sampling plan – Double Sampling Plan – Sequential Sampling Plan – Reliability on type I censoring, type II censoring and complete censoring.

2. SAMPLING THEORY AND METHODS:

Simple Random Sampling – Stratified Random Sampling – Systematic Sampling – Cluster Sampling for Single stage and Two stage – Ratio and Regression estimates – Double Sampling methods.

3. MULTIVARIATE ANALYSIS:

Test based on Discriminant function – Hotelling T^2 Statistic – Mahalanobis D^2 Statistic - Principal component analysis – Factor analysis - Single linkage method – complete linkage method – classification analysis – Divisive techniques.

4. STATISTICAL INFERENCE:

Point Estimation - Maximum Likelihood method – Method of Moments – Minimum Chi-Square method - Interval estimation – Most powerful test – Uniformly Most Powerful test – Likelihood Ratio test – Chi-Square goodness of fit test – Non-parametric Tests

04STAGE22

ELECTIVE – 2

OBJECT ORIENTED PROGRAMMING WITH C++

UNIT-I

Principles of Object – Oriented Programming – Software Evolution Procedure and Object Oriented Paradigm – Basic concepts of Object – Oriented Programming – Benefits of OOP – Object Oriented Languages – Application of OOP - Beginning with C++ - What is C++?. - Application of C++ - C++ statements – Structure of C++ Program – Tokens , Expressions and Control Structures – Tokens – Identifiers – Basic and User – Defined Data Types – Operators in C++ - Operator Overloading – Operator precedence – Control Structures.

UNIT-II

Functions in C++:- The Main Function – Function Prototyping – Call by Reference – Return by Reference – Inline functions – Function Overloading – Friend and Virtual Functions – Classes and Objects – Introduction – Specifying a Class – Defining Member function – Nesting of Member Function – Private member Functions – Arrays within a Class – Static Data Members- Static Member Function – Array of Objects – Objects as Function Arguments, Friendly Functions – Pointers to Members.

UNIT-III

Constructors and Destructors:- Constructors – Copy Constructor Dynamic Constructor- Constructing Two – Dimensional Arrays – Destructors – Operators Overloading –Type Conversions.

UNIT-IV

Inheritance, Extending Classes:- Defining Derived classes – Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance – Virtual Base Classes – Abstract Classes-

Pointers, Virtual Functions and Polymorphism – Pointers to Derived Classes – Virtual Functions.

UNIT-V

Managing Console I/O Operations:–C++ streams – C++ stream Classes – Unformatted I/O Operations - Formatted Console I/O Operations – Managing output with Manipulators- Working with Files:– Classes for File Stream Operations- Opening and Closing a File - File Pointers and their manipulators – sequential I/O Operations. Simple Statistical Problems.

Books for Study and Reference :

1. E.Balagurusamy (1998) : **Object Oriented Programming with C++**. Tata McGraw Hill Publishing Company Limited.
2. K.R.Venugopal, Rajkumar, T.Ravi shankar (1998): **Mastering C++**, Tai.

SEMESTER – III

AIMS:

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1. An understanding of the Statistical principles, techniques and applications of selected areas of Statistics and computing.
2. The ability to evaluate, select, write and use of computer software packages for Statistical theory which takes into account the needs of the user and constraints towards computing environment.
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01STABC07

CORE - 7

LINEAR MODELS AND DESIGN OF EXPERIMENTS

UNIT-I

Linear Models and Linear Model Assumptions on Error Components-Fixed/Mixed and Random Component Models-Gauss-Markov set up and its generalization-Linear estimation-Gauss-Markov theorem-BLUE-Test for Linear Hypothesis- Analysis of Covariance-Multiple Comparisons - Multiple Range Tests.

UNIT-II

Review of Basic Designs and Principles of Experimentation CRD-RBD-LSD. Construction of Orthogonal - Analysis of Graeco Latin Squares, Cross Over Designs, Split Plot and Strip Plot Designs.

UNIT-III

Construction and Analysis of Factorial Experiments Symmetrical and Asymmetrical Factorial- 2^n , 3^n , S^n and $p \times p$ Experiments - Concept and Principle of total, partial and balanced Confounding in Symmetrical Factorial.

UNIT-IV

Concept of Fractional Replication in Symmetrical Factorial $1/2$ and $1/4$ in replicate of 2^n , $1/s$ replicate of S^n Construction and Analysis. Concept of Orthogonal Arrays.

Response Surface experiments - first and second order Rotatable Designs and their Construction.

UNIT-V

Analysis of Block Designs, C-matrix and its properties, Concept of Connectedness and Orthogonality Simple and Balanced Lattice Designs-Balanced Incomplete Block Designs-Youden Square Design, Partially Balanced Incomplete Block Designs and its Classification, Group Divisible Designs.

Books for Study:

1. Montgomery, D.C. (1976): **Design and Analysis of Experiments**, John Wiley and Sons.
2. Graybill, F.A. (1968): **An Introduction to Linear Statistical Models**, McGraw Hill.
3. Aloke Dey (1986): **Theory of Block Designs**, Wiley Eastern.

Books for Reference:

1. Fisher, R.A. (1947): **The Design of Experiment**, Fourth Edition, Oliver and Boyd.
2. Federar, W.T. (1963): **Experimental Design Theory and application**, Mcmillian and Co., New York Oxford IBM.
3. Kempthorne, O (1965): **Design and Analysis**
4. Cochran, W.G. and Cox,G.M.: **Experimental Designs**, John Wiley.
5. Nigam,A.K., Puri, P.D and Gupta,V.K. (1988): **Character- isations and Analysis of Block Design**, Wiley Eastern.
6. Kshirsagar,A.M: **A Course in Linear Models** - Marcel Dekkar.

01STABC08

CORE - 8

OPERATIONS RESEARCH

UNIT-I

Review of LP problems -Methods using Artificial Variables- Two Phase Method - Principle of Duality-Dual Simplex Method- Transportation and Assignment Problems- Travelling Salesman Problem- Degeneracy and cycling.

UNIT-II

Games in Normal and Extended Forms, Fundamental Theorem of Matrix Games(without proof), Solution of 2×2 , $2 \times m$ and $m \times n$, Zero Sum Games by Dominance Principle, LP Representation and Graphical Methods. Sequencing and Scheduling Models, 2 Machine n-job problem (no passing), 3 Machine n-job problems.

UNIT-III

Introduction to Networks, Determination of Flows and of Critical Path, PERT, Multi-stage Decision Processes and Dynamic Programming, Delman's Principle.

UNIT-IV

Analytic Structure of Inventory Problems, EOQ formula, its Sensitivity Analysis and Extensions allowing Quantity Discounts and Shortages. Multi-Item Inventory subject to Constraints, Models with Random Demand, The Static Risk Model P and Q Systems with constant and Random Lead Times.

UNIT-V

Queueing Models-Specifications and Effectiveness Measures. The M/M/1, M/M/C and M/C/1 Queues and their steady state Solutions, Machine Interference Problems, Waiting Time Distributions for M/M/1 and M/M/C Models.

Books for Study:

1. Hadley, G. (1969): **Linear Programming**, Addison-Wesley.
2. Hillier, F. S. and Lieberman, G. J. (1962): **Introduction to Operations Research**, Holden Day.
3. Kanti Swarup, Gupta P.K., and Man Mohan. (1977): **Operations Research**, Sultan Chand and Sons.

Books for Reference:

1. Taha, H. A. (1982): **Operations Research**, Third Edition, Collier- McMillan.
2. Saaty, T. L. (1961): **Elements of Queueing Theory with Applications**, McGraw Hill.
3. Wagner, H. M. (1973): **Principles of Operations Research with Application to Managerial Decisions**, Prentice Hall of India.

01STABC09

CORE - 9

ECONOMETRICS

UNIT-I

Aitken's Generalised Least Squares (GLS) Estimator, Heteroscedasticity, Auto-Correlation, Test of Auto-correlation, Multicollinearity, Tools for Handling Multicollinearity, Linear Regression with Stochastic Regressors, Errors in Variable Models and Instrumental Variable Estimation, Independent Stochastic linear Regression, Auto regression, Linear regression, Lag Models.

UNIT-II

Simultaneous Linear Equations Model: Structure of Linear Equations Model, Identification Problem, Rank and Order Conditions, Single Equation and Simultaneous Equations, Methods of Estimation - Indirect Least Squares, Least Variance Ratio and Two-Stage Least Square.

UNIT-III

Statistical Inference in Simultaneous Equations Models: Some Basic Convergence Results, Conditions for Identification, Asymptotic Properties of Two-Stage Least Squares Estimator, Limited Information, Maximum Likelihood and K-class Estimators, Methods of Three-Stage Least Squares.

UNIT-IV.

Preparation of Macro Economic (Statistical) Framework- Projection of Macro Variables through the Econometrics Models - Sectoral Projections - Growth Elasticity Approach, Disaggregated Macro Model Approach, Input, Output Analysis, Specific Sectoral Studies.

UNIT-V

Project Selection-Criterion, Cost Benefit Analysis, Concepts of Net Present Value (NPV), Internal Rate of Return (IRR), Shadow Prices - Project Analysis.

Books for Study:

1. Johnston,J.(1984):**Econometric Methods**, Third Edition, McGraw Hill.
2. Gujarathi, D. (1979): **Basic Econometrics**, McGraw Hill.

Books for Reference:

1. Intriligator,M.D (1980): **Econometric Models-Techniques and Applications**, Prentice Hall.
2. Theil, H. (1971): **Principles of Econometrics**, John Wiley.
3. Walters,A.(1970):**An Introduction to Econometrics**, McMillan and Co.
4. Development Programming Techniques Series No. 1,5 & 6
5. **Planning Process and Programming Techniques**, (1972):economic Bulletin for Asia and far East, Vol23, No.2.
6. John Tibergon (1967): **Development Planning**, World Press.

04STAGE23

ELECTIVE - 3

VISUAL BASIC AND COMPUTER GRAPHICS

UNIT-I

Variables, Constants, Strings, Numbers, Remark and End Statements, String Data, financial and Numeric Functions, Programmed flow Control, User defined functions and Modules. Forms-Single document Interface, creating Controls, Event Procedure.

UNIT-II

Text Boxes & Labels – Properties window Usage – Custom controls – Picture Box, Rich Text Box, List Box, Progress Bar, Tree View, Toolbar, Slider Objects in VB-classes- Objects creation and Manipulation.

UNIT-III

Graphics – Line, Shape, Boxes, Circles, Ellipses and Pie charts, Help System - DDE Properties – DDE Events- DDE Methods – OLE Properties - Active X Controls – Creation & Usage - Data Control – Field Control – Data Grid – Record set Using SQL to Manipulate data.

UNIT-IV

Graphics- input-output devices: Direct input devices-cursor devices-direct screen interaction – logical input function – Cathode Ray tubes-Line drawing displays - Raster scan displays-hard copy devices.

UNIT-V

Two Dimensional graphics- 2D – Transformer and 2D – algorithms – Line drawing algorithms, Line covering – Line clipping, and Polyo clippings – Raster Graphics , Scan conversion of Polygons – region filling – algorithms.

Books for Study and Reference:

1. Gary Cornell,(1997):“**Visual Basic 5** from the Groundup” Tata McGraw Hill.
2. John R Ranken (1989)“**Computer graphics Software Construction**”, Prentice Hall of Australia Pvt, Ltd.
3. F.S.Hill J.R, (1990): **Computer Graphics**, Maxwell Macmillan International edition.

SEMESTER – IV

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1. To provide a broad based high quality education with combination of the subjects like Time Series and Stochastic Process, Application of Statistical Software Packages, Project and Viva voce and Practice of Life Assurance to Post-Graduate Degree level for students who have to demonstrate that they have the ability and potential towards Statistical Theory and Applications.

2. To develop knowledge, understanding and experience of the theory, practice and application of selected areas of Statistical computing and to produce graduates needed by public and private sector to help and solve practical problems using the skills and techniques of these areas, developing analytical skill for Insurance Sector.
3. To develop enterprise competences emphasizing the key skills of learning and communication for Statistical theory.

OBJECTIVES:

1. An understanding of the Statistical principles, techniques and applications of selected areas of Statistics and computing.
2. The ability to evaluate, select, write and use of computer software packages for Statistical theory which takes into account the needs of the user and constraints towards computing environment.
3. The ability and confidence to analyze and solve problems both of a routine and of obvious nature towards applications of Statistical theory.
4. To have gained deeper understanding, problem solving skills and greater knowledge of selected topics in statistical computation.

01STABC10

CORE - 10

TIME SERIES AND STOCHASTIC PROCESSES

UNIT-I

Introduction to Stochastic Process, Classification of Stochastic Process. Countable State Markov Chain. Chapman-Kolmogorov's Equations, Calculation of n-step Transition Probability and its limit. Stationary Distribution, Classification of States, Transient Markov chain, Random Walk and Gambler's Ruin Problem.

UNIT-II

Continuous Time Markov Process: Kolmogorov Differential Equations, Poisson Process, Birth and Death Process, Applications to queues and Storage problems.

UNIT-III

Discrete Parameter Stochastic Process/time series. Auto- Covariance and Auto-correlation and their properties.

UNIT-IV

Detailed study of the stationary process like (a) Moving Average, (b) Autoregressive, (c) Autoregressive moving average. (d) Autoregressive Integrated Moving Average, Box Jenkins Models, Brief discussion of Estimation and Related Large Sample theory of the mean.

UNIT-V

Choice of AR and MA terms. Brief discussion of techniques of the ARIMA model parameters and forecasting. Study of Residuals and Diagnostic Checking.

Books for Study:

1. Karlin, S. and Taylor, H.M. (1975): **A First Course in Stochastic Process**, vol.I, Academic Press.
2. Medhi, J. (1982): **Stochastic Process**, Wiley Eastern.
3. Fuller, W.A. (1976): **Introduction to Statistical Time Series**, John Wiley, New York.

Books for Reference:

1. Granger, C.W.J. and Newbold, (1984): **Forecasting Econometric Time Series**, Third Edition, Academic.
2. Box, G.E.P., and Jenkins, G.M., (1976): **Time series Analysis- Forecasting and Control**. Holden-Day San Francisco.
3. Anderson, T.W., (1971): **The Statistical Analysis of time Series**, Wiley, New York.
4. Kendall, M.G., and Stuart, A. (1966): **The advanced Theory of Statistics**, Vol.3, Charles Griffin, London.
5. Adke, S.R. and Manjunath, S.A. (1984): **An Introduction to Finite Markov Processes**, Wiley Eastern.
6. Parzen, E. (1962): **Stochastic Processes**, Holland-Day.

01STABC11

CORE - 11

STATISTICAL PRACTICAL – II

The Maximum Mark is 100 with 40 Marks for Internal involving Test and Record work. 60 Marks for End Examination. The candidate should attend 3 questions out of 4 questions each with 20 Marks with Internal choice. Problem relating to the areas listed below covered under Semester III and Semester IV. The Core Practical II examination is to be conducted at the end of the IV Semester. The list of topics included for practical are given below,

1. Linear Models and Design of Experiments:

Linear Models and Estimation of BLUE – Analysis of Covariance – Greco Latin Square Design – Split plot and Strip plot techniques – 2^n and 3^n factorial experiments with and without total and partial confounding - BIBD – PBIBD - Youden Square Design – Lattice Design.

2. Operations Research:

Artificial Variable – Dual Simplex methods – Game with and without saddle point – Dominance principle and job sequencing problems – PERT and CPM techniques – Inventory problems – Queueing problems.

3. Time Series and Stochastic Processes:

Countable state Markov chain – Gamblers ruin problem – Poisson Process – Box Jenkins models – ARIMA model parameters and forecasting.

07STABC25

CORE – 13

APPLICATION OF STATISTICAL SOFTWARE PACKAGES

UNIT-I

Introduction to Excel – Various Distributions - Descriptive Statistics - Data analysis tools –ANOVA – Covariance - Regression – Correlation – Non parametric tests — Time series analysis - Using Macros

UNIT-II

Introduction to SPSS 10.0 Icons - Opening files - File extension - Working with Data - Summarizing Data and Printing - Hypothesis Testing - Descriptive statistics for qualitative and quantitative data – Graphs and Charts - Regression and Correlation Analysis - Simple Correlation – scatter diagram, Simple Regression – scatter diagram, Simple Regression – Estimation and Interpretation of results, Multiple Regression Scatter plot Matrix - Multiple Regression - Estimation and Testing of Hypothesis - Time Series Analysis and Forecasting – Linear Trend – Non – Linear Trend – Seasonality –Forecasting with Linear Trend and regression Models - Index Numbers.

UNIT-III

Introduction to MINITAB 14.2 – Preliminary data analysis – Descriptive statistics – Probability theory – Inferential Statistics for single through multiple samples.

UNIT-IV

Introduction to STATISTICA 7- Basic Statistical Analysis Methods – ANOVA – Nonparametric – Distribution Fitting – Multiple Regression – General Linear / Nonlinear models – General Regression Models – Time Series and Forecasting models – Cluster, Factor, Principal Component and Discriminant Analysis – Quality Control Charts – Experimental Design (DOE) – Process Analysis

UNIT-V

Case studies – Problem Solving and Applications of SPSS, Statistical Process Control, MINITAB, STATISTICA and MS Excel

Websites:

www.spss.com/Help

www.stata.com

www.spss.org

Help manuals of SPSS version 10

Manual of MINITAB

Books for Study and Reference:

1. **SPSS for Windows Step by Step: A simple Guide and Reference**, 10.0 update (3rd edition) by Darren George and Paul Mallery
2. **An Introductory Guide to SPSS for Windows** by Eric L. Einpruch
3. Borovikov, I.P. and Borovikov, V.P. **STATISTICA: Data Preparation and Analysis**. Moscow: Filini, (1998)
4. Borovikov, V.P. **A Quick Introduction to STATISTICA**. Moscow: Computer, (1998)
5. **The Complete Idiot's Guide to Microsoft Excel** (2000) By Sherry Kinkoph
6. **How to Do Everything with Microsoft Office Excel** (2003) By Guy Hart - Davis

01STABP12

CORE - 12

PROJECT WORK

Project work shall be carried out under the supervisor of a Faculty member on the recommendation of the Head of the Department. **Three copies** of the Project report should be submitted atleast two weeks before the last working day of the fourth semester. The Project work with components are:

Internal Assessments : 30%

Evaluation of Project report by External

Examiner and Guide : 40 %

**Supervisor and External Examiner : 30 %
by Viva-Voce**

The Evaluation of the Project will be based on Project Report and a VIVA-VOCE examination to be conducted by the Supervisor and an External Examiner.

**List of Elective & Supportive Papers offered for
Other Department Students**

Details of the Subjects offered and Scheme of Examinations

Elective Papers					
Subject Code	Title of the papers	Credit Point	Internal	End Exam	Total Marks
01STAGE1 3	Bio-Statistics	4	40	60	100
01STAGE1 5	Statistics for Management	4	40	60	100
01STAGE1 6	Operations Research Methods	4	40	60	100
01STAGE1 4	Probability and Statistics	4	40	60	100
06STAGE2 4	Actuarial Statistics	4	40	60	100

Supportive Papers					
Subject Code	Title of the papers	Credit Point	Internal	End Exam	Total Marks
01STAGS17	Descriptive Statistics	2	20	30	50
01STAGS20	Statistical Methods for Researchers	2	20	30	50
01STAGS19	Statistical Methods for Industries	2	20	30	50
01STAGS18	Data Analysis	2	20	30	50
06STAGS21	Statistical Methods for Biologists	2	20	30	50
06STAGS22	Elements of Operations Research	2	20	30	50

01STAGE13

ELECTIVE –I

BIO-STATISTICS

UNIT-I

Nature of biological and Clinical experiments and data - Classification of data -Need and nature of tabulation - Charts and Diagrams for data - Bar diagrams, pie diagrams, pictograms, histograms-frequency curves and their use.

UNIT-II

Measures of Central tendency - Mean, Median, Mode, Geometric mean, Use of these averages in biological Studies.

Measures of deviation and Standard deviation – Co-efficient of variation -Measure of Skewness and Kurtosis.

UNIT-III

Correlation and regression theory - Correlation coefficient - rank correlation - Regression equations (only problems) - Multiple and Partial correlation and regression.

Basic concepts of sampling - Simple random sample - Stratified sample -Systematic samples.

UNIT-IV

Test of significance based on large sample test: for mean - Variance and proportions-test for means, Variance and attributes using t, F and Chi-Square distribution. Test for correlation regression coefficients, Chi-Square test for goodness of fit.

UNIT-V

Analysis of variance: One way and two way Classifications - Completely Randomized blocks - Randomized Block Design and Latin Square Design (Simple problems based on biological and biochemical data).

Books for Study and Reference:

1. Sundar Rao, Jesudian, Richard - **An Introduction to Biostatistics**, Wiley.
2. Alvi E-Lewis-**Biostatistics**-Eastwest Press.
3. Daniel. Wayne : **Bio-Statistics**, Wiley.
4. Campell-**Statistical for Biologist**, Wiley.
5. Zar.S **Bio-Statistics**, Prentice Hall India.

01STAGE15

ELECTIVE-II

STATISTICS FOR MANAGEMENT

UNIT-I

Nature of quantitative analysis in Management, purpose of Statistics, Measurements, attributes, Units, Variables, discrete and Continuous.

Need and nature of tabulation-Charts and diagrams for data-Bar diagrams, pie diagrams, pictograms-frequency curves.

UNIT-II

Measure of Central tendency-Mean, Median, Mode-Measure of dispersion - Quartile deviation, Mean deviation and Standard deviation-Coefficient of variation-Measure of Skewness and Kurtosis.

UNIT-III

Concepts of events-probability of events-joint, conditional, Marginal probabilities-Probability distribution of a Random variable-Expected value and variance.

UNIT-IV

Theoretical probability distribution-Binomial, Normal and students t distributions.

UNIT-V

Estimation-population and sample-population parameters-Central Limit and theorem-point estimate and interval estimates of population mean and population proportion.

Concept and Construction of Index numbers. Understanding Index numbers applicable in the context of economics, business and Management.

Books for Study and Reference:

1. Richard Levin, **Statistics for Management**. Prentice Hall.
2. Paul Marton, **Applied Business Statistics**, Holt and Reinlast.
3. Good and Hatt, **Research Methods on Social Science**.

01STAGE16

ELECTIVE-III

OPERATIONS RESEARCH METHODS

UNIT-I

Linear Programming-Graphical Method for two-dimensional problems-General Problem of Linear programming-Variations-Definitions-Statements of basic theorems & properties. Phase I and Phase II of the Simplex Method-Sensitivity analysis-transportation Problem and its Solution. Assignment Problem and its Solution Duality and Shadow Price.

UNIT-II

Queueing theory: Characteristics of queueing Systems-Steady State M/M/1, M/M/C and M/M/K queueing Models.

Replacement theory: Replacement of items that deteriorate- Replacement of items that fail - Group replacement.

UNIT-III

Inventory theory: Costs involved in inventory Problems-Single item deterministic Model-Economic lot size Models without shortages & with shortages having production rate infinite & finite.

UNIT-IV

Decision Making: Decision under certainty, uncertainty & under risk. Decision trees- expected value of Project information & imperfect information.

UNIT-V

PERT & CPM: Arrow networks-time estimates-earliest expected time, latest allowable occurrence- critical path- probability of meeting scheduled time of completeness of projects-calculations on CPM networks, various floats for structures- external path-updating project-operation time cost trade of curve.

Books for Study and Reference:

1. Kanti Swarup, Gupta P.K., and Man Mohan.(1977): **Operations Research**, Sultan Chand and Sons.
2. Taha, H.A (1982): **Operations Research**, Third Edition, Collier- McMillan.
3. Ackoff,R.L. and Sasieni,M.W (1968):**Fundamentals of Operations Research**,John Wiley.

01STAGE14

ELECTIVE-IV

PROBABILITY AND STATISTICS

UNIT-I

Sample spaces – events – Probability axioms – Conditional Probability – Independent events – Baye’s formula- Random Variables - Distribution functions – Marginal distributions, Conditional distribution – Stochastic Independence. Expectation – Conditional expectation and Conditional Variance. Moment generating functions – Cumulant generating functions.

UNIT-II

Probability distributions – Binomial,Poisson,geometric, Uniform, exponential, normal, gamma, beta (generating function, Mean, variance & Simple problems).

Correlation – Regression – Multiple & Partial Correlation & regression(Only Problems).

Probability density function & Properties to t,f, Chi-square distributions.

UNIT-III

Test for means, Variances & attributes using the above distributions large sample tests – tests for means, Variances & Proportions.

Analysis of Variance: One way and two way classifications – Complete Randomized blocks – Randomized Block Design and Latin Square Design (Only Problems).

UNIT-IV

Estimation: Point estimation – Characteristics of estimation – Interval estimation – Interval estimates of Mean, Standard deviation, proportion, difference in Means & ratios of Standard deviations.

Time series analysis: Trend & Seasonal variations – Box – Components of time Series – Measurement of trend – linear & Second degree Parabola.

UNIT-V

Statistical quality control – Statistical basis for control charts – Control limits – Control Charts for variables – X,R Charts, Charts for defective – P, nP Charts – charts for defects – C Charts..

Books for Study:

1. K.S.Trived, (1982): **Probability & Statistics with reliability, queueing & Computer applications**, Prentice Hall.
2. S.C.Gupta & V.Kapoor, (1977) : **Fundamentals of Mathematical Statistics**, Sultan Chand & Sons.

Books for Reference:

1. Montogomery.DC, and Johnson.A, (1976): **Forecasting & time Series analysis**, McGraw Hill.
2. Dajeh Bester field, (1986): **Quality Control**, Prentice Hall.

01STAGS17

SUPPORTIVE-I

DESCRIPTIVE STATISTICS

UNIT-I

Origin-Scope-Functions, limitations, uses and Misuses of statistics. Classification and Tabulation of data, Diagrammatic and graphic representation of data.

UNIT-II

Measure of Central tendency–Measures of Dispersion-relative measures of dispersion-Skewness and Kurtosis-Lorenz's curve.

UNIT-III

Elementary Probability space-Statistical probability Axiomatic approach to probability-Finitely additive and countable additive probability functions-Addition and multiplication theorems-Conditional probability-Bayes theorem-Simple problems.

UNIT-IV

Random variables-Discrete and continuous random variables-Distribution function and probability density function of a random variable-Expectation of a random variable-Addition and product theorems- Evaluation of standard measures of location, dispersion, Skewness and Kurtosis.

UNIT-V

Simple linear correlation and regression-Regression equations-their properties spearman's Rank correlation Co-efficient.

Books for Study:

1. Goel & Sharma : **Mathematical Statistics**.
2. S.P.Gupta (1969): **Statistical Method**, Sultan Chand and Sons.
3. S.C.Gupta & V.K.Kapoor (1977): **Fundamentals of Mathematical Statistics**, Sultan Chand and Sons.

Books for Reference:

1. A.M.Goon, Gupta & Das Gupta: **Fundamentals of Statistics**, Vol.1 World press Ltd, Calcutta.
2. Rohatgi, V.K.: **An introduction to Probability Theory and Mathematical Statistics**, Wiley Eastern Ltd., New Delhi.

01STAGS20

SUPPORTIVE - II

STATISTICAL METHODS FOR RESEARCHERS

UNIT-I

Definition of Statistics and its applications in various disciplines - Collection of Data - Classification, Tabulation and graphical representation of data- Construction of univariate and Bivariate frequency distribution-measures of central tendency-measures of dispersion - coefficient of variation.

UNIT-II

Random experiment-sample space-events-mathematical and statistical definition of probability-conditional probability-Bayes' theorem-random variable-distribution function-moments- Binomial distribution-Poisson distribution-normal distribution and their properties

UNIT-III

Scatter diagram-Karl Pearson's coefficient of correlation - concurrent deviation method-coefficient of determination-Spearman's Rank correlation-Linear regression-regression lines.

UNIT-IV

Tests of significance-types of hypotheses-two types of errors-critical region-level of significance, small sample tests based on t, F distribution, Chi-square test of goodness of fit, contingency table-test of independence of factors-Large sample tests.

UNIT-V

Test of equality of several populations means, one way and two way analysis of variance. Non-parametric tests-sign, Run and Median tests-two sample rank test-sampling and its uses, sampling methods- unrestricted Random sampling (SRS)- Restricted Sampling (Stratified and Systematic).

Books for Study and Reference:

1. Agarwal (1980): **Basic Statistics**, Wiley Eastern
2. Sokal P.R. and Rohlf F.J. (1969): **Bio Statistics**, W.H. Freedom & Co, San Francisco
3. Snedecor G.W. and Cochran W.G. (1967): **Statistical Methods**, Oxford-IBH, Pvt Co.
4. Zar,J.H.(1984): **Bio Statistical Analysis**, Prentice Hall,Inc, London.

01STAGS19

SUPPORTIVE - III

STATISTICAL METHODS FOR INDUSTRIES

UNIT-I

Historical development of Statistical Quality Control - Meaning of Quality - improvement - Quality cost - Total Quality Management - causes of variations - X, R, P and C charts.

UNIT-II

Acceptance sampling plans by Attributes - Single Sampling Plan - Double Sampling Plan - OC curves - AOQ, ATI curves, Dodge Roaming AOQL and LTPD plans, MIL - STD 105D plans.

UNIT-III

Variable Sampling Plan - One sided and Two sided specifications - Taguchi philosophy and contributions to Quality Improvement (Basic concepts only)

UNIT-IV

Test of significance and design of experiments: Tests based on t, F and chi-square distributions - Analysis of variance - One way and Two way classification Complete Randomized Design(CRD), Randomized Block Design(RBD) , Latin Square Design(LSD).

UNIT-V

Basic of reliability theory - Life time distribution - Hazard rate- Survival function- Exponential, Weibull, Gamma and life time distributions

Books for Study and Reference:

1. Montgomery, DC (1991) **Introduction of Statistical Quality Control**, John Wiley and Sons.
2. Sivazlian and Stanfel (1975), **Analysis of Systems in Operations Research**, Prentice Hall

01STAGS18

SUPPORTIVE-IV

DATA ANALYSIS

UNIT-I

Sampling procedure - determination of Sample size and selection of sample formation of questionnaire- Structured and unstructured questionnaire. Field work- Execution of survey-data collection, Scaling techniques -Guttman scale-Likert 5 points scale.

UNIT-II

Summarizing data- tabulation- averages- Dispersions- measurement of risk- relative measures of dispersion-efficiency and consistency- comparison of two or more populations- large samples test, small sample test - ANOVA - Application of Statistical packages.

UNIT-III

Association of attributes: Chisquare test- correlation-rank difference correlation/biserial correlation, point biserial correlation. Significance of correlation, rank correlation and biserial correlation coefficient, partial and multiple correlations. Significance of multiple regression equation-significance of b_0, b_1, \dots, b_n the liner regression coefficient- application of statistical packages.

UNIT-IV

Non-parametric tests: Tests for randomness, Run test, Sign test, and Mann Whitney U test. Wilcoxon signed rank test. Median test- Statistical packages

UNIT-V

Curve fitting - Curves of type
 $Y=a+bx+cx^2$ $Y= abx$
 $Y =a+bx+cx$ $Y=a.ebx$

Time series -estimates of trend and seasonal variation -forecasting -statistical packages.

Books for Study and Reference :

1. Siegel, sand Castellan, NJ (1988): **Non-Parametric Statistics for Behavioral Science** McGraw Hill Book Co, New York
2. Srivastava UK, Shenoy GC and Sharma SC (1989): **Quantitative Techniques Managerial Decision** Wiley Eastern ,New Delhi.
3. VK Kapoor and SC Gupta, (1986): **Fundamentals of Mathematical Statistics**, Sultan Chand and sons, New Delhi
4. Garrett H.E, (1973): **Statistics in Psychology and Education**. Vakils, Feffer and Simons Pvt. Ltd.
5. Hoel P.G. (1957): **Introduction to Statistics**, Asia Publishing Housing Pvt Ltd, New Delhi
6. Kothari CR (1984): **Quantitative Techniques**, vikas Publishing House Pvt Ltd, New Delhi
7. Kothari CR (1990): **Research Methodology**, Wiley Eastern Ltd, New Delhi

07STABD31

DIPLOMA - I

FINANCIAL MATHEMATICS

UNIT-I

Generalized cash flow model for financial transaction, making allowance for the probability of payment, Time value of money using the concepts of compound interest and discounting, Interest rates or discount rates in terms of different time periods.

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UNIT-II

Calculation of the present value and the accumulated value of a stream of equal or unequal payments using specified rates of interest and the net present value at a real rate of interest, assuming a constant rate of inflation.

UNIT-III

Use of compound interest function, Equation of value, Repayment by regular installments of interest and capital, Discounted cash flow techniques.

UNIT-IV

The investments and risk characteristics of the following types. Simple compound interest problems, The delivery price and the value of the forward contract using arbitrage free pricing methods.

UNIT V

Structure of interest rates, Simple Stochastic interest rate models

Books for Study and Reference:

1. Bowers, Newton.L. et al (1997): **Actuarial Mathematics**, Society of Actuaries, 2nd Edition.
2. Meculcheon, John, J. Scott William F (1986): **An Introduction to Mathematics of Finance**, London, Heinemamr.
3. Study Material of Actuarial Education company – London (1988) for subject 1 **Fundamentals of Actuarial Mathematics.**

07STABD32

DIPLOMA - 2

PRINCIPLES OF INSURANCE

UNIT-I

Concepts of risk, concept of Insurance, Classification of Insurance, Type of Life Insurance, pure and terms, Types of general Insurance, Insurance Act, Fire, Marine, Motor, Engineering, Aviation and Agricultural, Alternative Classification, Insurance Property, Pecuniary interest, liability and person, Distribution between Life and General Insurance.

UNIT-II

History of Insurance in General in India, Economic Principles of Insurance, Legal principles of Insurance, The Indian contract Act 1872, Insurable interest, Nomination and assignment, Utmost Good faith, Indemnity, Subrogation, contribution, Proximate cause.

UNIT-III

Representations, Warranties, Conditions

UNIT-IV

Financial Principles, Premium income and outgo investments, Reserves, Surplus, Profit, Valuation of surplus.

UNIT-V

Theory of rating, Actuarial principles, Mortality tables, Physical and Moral Hazard, Risk appraisal, Risk selection, Under writing, Reinsurance, concepts and methods.

Books for Study and Reference:

1. Neill, Aistair, Heinemann (1977): **Life Contingencies.**
2. Gerber, Hans, U (1997): **Life Insurance Mathematics**, Springer, Swiss association of actuaries.

3. Booth, Philip N. et al (1999): **Modern Actuarial Theory and Practice**, Chapman and Hall.
4. Dayken, Chris.D et al (1994): **Practical Risk Theory for Actuaries**, Chapman and Hall.

07STABD33

DIPLOMA - 3

ACTUARIAL MATHEMATICS

UNIT-I

Concept of Decision theory and its applications, Concepts of Bayesian Statistics, Calculation of Bayesian Estimators

UNIT-II

Calculate Probabilities and Moments of loss distributions both with and without simple reinsurance arrangements, Construct Risk Models appropriate to short term insurance contracts and calculate MGF and Moments for the risk Models both with and without simple reinsurance arrangements.

UNIT-III

Calculate and appropriate the aggregate claim a distribution for short term insurance contracts.

UNIT-IV

Explain the concept of ruin for a Risk Models, Calculate the adjustment coefficients and state Lund berg's inequality, Describe the effect on the Probability of Ruin of changing parameter values and of simple reinsurance arrangements.

UNIT-V

Describe and apply the fundamentals concepts of credibility theory, Describe and apply the fundamental concepts of simple experience rating systems.

Books for Study and Reference:

1. Horrack, Ian B. Pollard, John H.Zehnwirth, Benjamin (1999): **Introductory Statistics with applications in general insurance**, 2nd Edition, Cambridge University press
2. Dobson, Annette J (1983): **An Introduction to Statistical Modeling**, Chapman Hall

07STABD34

DIPLOMA - 4

PRACTICE OF LIFE ASSURANCE

UNIT-I

Life insurance organization, The Indian context, The Distribution system, function of appointment and continuance of agency, remuneration of agents, trends in life insurance distribution channels.

UNIT-II

Plans of Life insurance, need levels, term life increasing, decreasing term policy, whole life insurance endowment insurance, money back endowment plan, marriage endowment plan, education annuity plan, children deferred assurance plans annuities.

UNIT-III

Group insurance, nature of group insurance types of group insurance, gratuity liability, group superannuating scheme, other group schemes, social security schemes, other special need plan, industrial life insurance salary saving scheme, disability plans.

UNIT-IV

Application and acceptance, prospectus, proposal forms and other related documents, age proof, special reports, policy documents, need and format, preamble operative conditions clauses, proviso, schedule, attestation conditions and privileges, alteration duplicate policy, premium, premium calculation, days of grace, non-forfeiture options, lapse and revival schemes.

UNIT-V

Assignment nomination loans, surrenders, foreclosures, Married women's property act policy, calculations, policy claims, maturity claims, survival benefit payments, death claims, waiver of evidence of title, early claims, claim concession, presumption of death accident benefit and disability benefit settlements options valuations and bonus, distribution of surplus, Types of reinsurance, exchange control regulations payment of premia payment claims etc., assignment in favor of non-residents deposit export of policies

Books for Study and Reference:

1. Booth, Philip, M et. al. (1999): **Modern Actuarial Theory and Practice**, Chapman Hall
2. Panjer, Harry H et. al. (1998): **Financial Economics with Applications to Investments Insurance and Pensions**, The Actuarial Foundations