MAJOR PAPER I DESCRIPTIVE STATISTICS (STMA)

Credits : 4

(5 hrs/week)

Objective : To introduce basic statistical concepts.

UNIT 1:

Nature and scope of statistical methods and their limitations-Preparation of questionnaire and schedule- primary and secondary sources of data-nominal, ordinal, ratio and interval scale.

UNIT 2:

Presentation by tables and diagrams: construction of tables with one, two and three factors of classifications-diagrammatic representations, frequency distributions for continuous and discrete data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods) and ogives.

UNIT 3:

Measures of location, dispersion, moments and measure of skewness and kurtosis for both grouped and ungrouped data .

<u>UNIT 4:</u>

Principle of least squares - fitting of first, second degree and exponential curves. Correlation: scatter diagram, correlation coefficient and its properties. Spearman's rank correlation. Regression coefficients and its properties, regression equations.

UNIT 5:

Fundamental set of frequencies, consistency of data, conditions for consistency, contingency table, association of attributes and various measures of associations.

- 1. Freund, J.E. (2002): Mathematical Statistics with applications, Pearson Education.
- 2. Gupta, S.C and Kapoor, V.K. (2002): Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd. New Delhi.
- 3. Gupta, S.P. (2005): Statistical Methods, Sultan Chand & Sons Pvt. Ltd. New Delhi.
- 4. Pillai, R.S.N and Bagavathi, V. (2003): Statistics, S. Chand and Company Ltd. New Delhi.

- 1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (1991): Fundamentals of Statistics Volume 1, World press, Calcutta.
- 2. Kapoor, J.N. and Saxena, H.C. (2002): Mathematical Statistics, S. Chand & Sons Pvt. Ltd., New Delhi.

MAJOR PAPER II PROBABILITY AND RANDOM VARIABLES (STMB) Credits : 4 (5 hrs/week)

Objective : To introduce the basic concepts in probability.

<u>UNIT 1:</u>

Random experiment, sample point, sample space, Classical and relative frequency approach to probability, Axiomatic approach to probability. Addition theorem of probability-simple problems. Boole's inequality.

UNIT 2:

Conditional probability, independence of events, multiplication theorem. Bayes theorem and its applications-simple problems.

<u>UNIT 3:</u>

Random variable - discrete and continuous, distribution functions, probability mass function, probability density function and their properties. Measures of location, dispersion, skewness and kurtosis for discrete and continuous variates. Joint, marginal and conditional distributions –simple problems.

<u>UNIT 4:</u>

Mathematical Expectation- addition theorem and multiplication theorem - Covariance- conditional expectation, conditional variance – simple problems.

<u>UNIT 5:</u>

Moment generating function, characteristic function, cumulant generating function-their properties – simple problems. Statement of uniqueness theorem and inversion theorem. Chebychev's inequality-simple problems.

- 1. Gupta, S.C and Kapoor, V.K. (2002): Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd., New Delhi.
- 2. Hogg, R.V., McKean, J. W. and Craig, A.T. (2006): Introduction to Mathematical Statistics, Sixth Edition, Pearson education, India.
- 3. Mood, A.M., Graybill, F.A. and Boes, D.C. (1974): Introduction to theory of Statistics, McGraw Hill.

- 1. Rohatgi, V.K. and Saleh, A.K.Md.E. (2002): An introduction to probability and Statistics, John Wiley and Sons.
- 2. Sanjay Arora & Bansilal (1989): New Mathematical statistics, Meerat Publications, New Delhi.

MAJOR PRACTICAL I BASED ON MAJOR PAPERS – I & II (STA2)

Credits : 3

(3 hrs/week)

Objective : To develop computing skills in solving statistical problems.

- **NOTE:** Record 10 Marks, Practical Examination Marks 50. Five questions are to be set without omitting any unit. Candidates are to answer any three questions.
 - 1. Construction of univariate and bivariate distributions with samples of size not exceeding 200.
 - 2. Diagrammatic and graphical representation of data and frequency distribution.
 - 3. Cumulative frequency distribution Ogives Lorenz curve.
 - 4. Measure of location and dispersion. (Absolute and relative)
 - 5. Curve fitting by the method of least squares.

(i) $y=ax + b(ii) y=ax^2 + bx + c$ (iii) $y=ae^{bx}$

- 6. Computation of correlation coefficient and regression lines for raw and grouped data. Rank correlation coefficient.
- 7. Construction of contingency table and testing the consistency of data.
- 8. Computation of various measures of associations of attributes.
- 9. Rank of a matrix of order $p \ge q (p, q \le 4)$.
- 10. Inverse of a non singular matrix by
 - i. Sweepout method
 - ii. Cayley Hamilton theorem
- 11. Solution to system of linear equations.
- 12.Determination of characteristic roots and characteristic vectors of second and third order square matrices.

MAJOR PAPER III DISTRIBUTION THEORY (STMC)

Credits: 4

(5 hrs/week)

Objective: To introduce various probability distributions and their applications.

<u>UNIT 1:</u>

Standard univariate distributions - Point distribution, Uniform, Binomial, Poisson, Geometric distribution and their properties- moment generating function, characteristic function for the above distributions. Hyper geometric, Multinomial, Negative Binomial – mean and variance only.

<u>UNIT 2:</u>

Standard continuous distributions - Uniform, Exponential, Gamma, Beta, Laplace, Pareto, Weibull, Cauchy distributions and their properties moment generating function and characteristic function for the above distributions.

<u>UNIT 3:</u>

Normal, Lognormal distributions – properties, moment generating function and characteristic function. Bivariate Normal distribution- its marginal and conditional distributions.

<u>UNIT 4:</u>

Order statistics – distribution of first, n^{th} and i^{th} order statistics – joint distribution of r^{th} and s^{th} order statistics – distribution of median and range – simple problems

<u>UNIT 5:</u>

Convergence in probability - Weak law of large numbers – convergence of distributions – Binomial to Poisson – Demoivre's – Laplace theorem – Central limit theorem due to Lindberg – Levy's CLT for i.i.d random variables.

- 1. Gupta,S.C.and Kapoor,V.K.(2002): Fundamentals of Mathematical Statistics, Sultan Chand and Sons Pvt. Ltd. New Delhi.
- 2. Sanjay Arora and Bansilal (1989): New mathematical Statistics, Meerat Publications, Satya Prakashan, New Delhi.
- 3. Hogg, R.V., McKean, J. W. and Craig, A.T. (2006): Introduction to Mathematical Statistics, Sixth Edition, Pearson education, India..

- 1. Mood, A.M., Graybill, F.A. and Boes, D.C. (1974): Introduction to the theory of statistics, International student ed., McGraw Hill 4th edition, Academic Press.
- 2. Rohatgi, V.K. and Saleh, A.K.(2001): An introduction to probability and Statistics, John Wiley and Sons.

ALLIED II – PAPER I PROGRAMMING IN C++ (YPGAA)

Credits: 4

(5 hrs/week)

Objective : To impart programming skills using C++ .

<u>UNIT 1:</u>

Character set – Tokens - Keywords – Variables (identifiers) - Declaration and initialization of variables – Reference variables – Constants (string, numeric, character and symbolic constants). Arithmetic operators – Relational operator – Logical operator – Assignment operator – Increment and decrement operators – mathematical functions.

<u>UNIT 2:</u>

If statement – if...else statement – switch statement – while statement – do...while statement – for statement – break statement – continue statement – simple programs. Arrays – One dimensional arrays – Two dimensional arrays – strings – simple problems. Defining a function – Advantages of using a function – main function – return statement – Function overloading. Structures.

<u>UNIT 3:</u>

Object-Oriented programming – advantages of OOP over procedure oriented programming – OOP language. What is C++? – features and applications of C++ - Source code and object code – C++ compilers – Features of iostream.h – Comments – Input/Output using cin/cout, gets/puts , getchar/putchar and getc/putc.

<u>UNIT 4:</u>

Class- General form of a class declaration – Creating objects – Accessing class members – Defining member functions outside/inside the class – Arrays within a class – Memory allocation for objects – Arrays of objects. Constructors and Destructors.

<u>UNIT-5:</u>

Operator Overloading and Type conversions . Inheritance - Single Inheritance - Multilevel Inheritance - Multiple Inheritance - Hierarchical Inheritance - Hybrid Inheritance. **NOTE:** Students should be trained in writing Statistical Programs (mean, Median, variance, skewness, kurtosis, correlation, regression – only for Raw data. Matrix manipulation – addition, multiplication, trace and transpose). Programs can be asked in section C from the above list.

BOOKS FOR STUDY:

- 1. Balaguruswamy, E. (2001): Programming in C++ , Tata McGraw Hill Publishing Company ltd. , NewDelhi.
- 2. Venugopal, K.R., Rajkumar Buyya and Ravishankar, T. (2006): Mastering C++, Tata McGraw Hill Publishing Company ltd., NewDelhi.

BOOK FOR REFERENCE:

1. Hubbard, J. (1996): Programming with C++, Schaum's Outline series, McGraw Hill.

MAJOR PAPER IV ESTIMATION THEORY (STMAD)

Credits : 4

(5 hrs/week)

Objective : To equip the students with various methods of estimation.

<u>UNIT 1:</u>

Sampling distributions – distributions of mean and variance from normal population. Sampling distributions of Chi-Square, t and F statistics.

<u>UNIT 2:</u>

Point Estimation – Problem of Point Estimation – Properties of estimators – Consistency and Efficiency of an estimator. Sufficiency of a statistic – Neyman factorization theorem - simple problems.

<u>UNIT 3:</u>

Unbiasedness – Properties, MVUE, BLUE, Rao-Blackwell theorem – Cramer Rao inequality - simple problems.

<u>UNIT 4:</u>

Methods of estimation: Method of moments, Method of Maximum Likelihood, Method of Minimum chi square, Method of modified minimum chi-square, Method of minimum variance – properties of estimators obtained by these methods - simple problems.

<u>UNIT 5:</u>

Interval Estimation – Confidence Interval for proportions, mean(s), variance and variance ratio based on chi square, student's t, F and Normal distributions. Tests of significance: concepts, tests based on normal, t, F and Chi Square.

- 1. Goon, A.M., Gupta, M.K. and Dasgupta, B. (1980): An outline of Statistical theory, Volume I, 6th revised ed., World Press limited, Calcutta.
- 2. Hogg, R.V., McKean, J. W. and Craig, A.T. (2006): Introduction to Mathematical Statistics, Sixth Edition, Pearson education, India.
- 3. Mood, A.M., Graybill, F.A. and Boes, D.C. (1974): Introduction to the theory of statistics, International student ed., McGraw Hill.

- 1. Degroot, M.H. (1975): Probability and Statistics, Addison-Wiley.
- 2. Hoel, P.G. (1971): Introduction to mathematical statistics, Asia Publishing house.
- 3. Rohatgi, V.K. and Craig, A.T.(1972): An Introduction to probability theory and mathematical statistics, Wiley Eastern.
- 4. Speigal, M.R.(1982): Theory and problems of probability and statistics, Schaum's outline series, McGraw Hill.
- 5. Snecdor, G.W. and Cochran, W.G. (1967): Statistical Methods 6th edition, Oxford IBH Publishing Co.
- 6. Wilk, S.S. (1962): Mathematical statistics, John Wiley & Sons.

MAJOR PRACTICAL II BASED ON MAJOR PAPERS – III & IV (STA4)

Credits : 3

(3 hrs/week)

Objective : To give hands on training for inferential problems.

NOTE: Record 10 Marks, Practical Examination 50 Marks. Five questions are to be set without omitting any unit. Candidates are to answer any three questions.

- 1. Fitting of Binomial, Poisson, Negative Binomial and Normal Distributions.
- 2. Drawing random samples of size not exceeding 25 from Binomial, Poisson, Uniform, Cauchy, Normal and Exponential distribution with known mean and variance using random number tables.
- 3. Estimation of parameters by method of moments (discrete and continuous distributions).
- 4. Estimation of parameters by method of maximum likelihood (discrete and continuous distributions).
- 5. Estimation of parameters by method of minimum chi-square (discrete and continuous distributions).
- 6. Estimation of parameters by method of minimum variance (discrete and continuous distributions).
- 7. Confidence intervals based on Normal, t, F and chi-square statistic.
- 8. Asymptotic and exact tests of significance with regard to population proportion(s), mean(s), variance, ratio of variances and coefficient of correlation, regression coefficients.
- 9. Independence tests by contingency tables of order $p \ge q (p, q=5)$

ALLIED II – PAPER II NUMERICAL METHODS (YNSAA)

Credits : 4

(5 hrs/week)

Objective : To train the students with the basic concepts of numerical methods.

<u>UNIT 1:</u>

Finite differences – forward and backward differences operators E and delta, and their basic properties – interpolation with equal intervals – Newton's forward and backward differences formulae - simple problems.

UNIT 2:

Interpolation with unequal intervals – divided differences and their properties – Newton's divided differences formula – Lagrange's formula-simple problems.

<u>UNIT 3:</u>

Central difference interpolation formula – Gauss forward and backward differences formulae – Sterling's, Bessel's, Everett's central difference formula.

<u>UNIT 4:</u>

Inverse interpolation – Lagrange's method – simple problems – Solution to transcential equations – bisection and Newton Raphson's method – Solution to system of linear equations – Gauss elimination, Gauss Seidel method and Horner's method, Stirling's approximation.

<u>UNIT 5:</u>

Numerical differentiation – Numerical differentiation up to 2^{nd} order only - simple problems. Numerical integration – trapezoidal rule – Simpson's one third and three eighth rule – Weddle's rule - simple problems.

1. Balasubramanian: Numerical Mathematics, Vol. II and I

- 1. Gupta, P.P. and Malik, G.S. (2006): Calculus of finite differences and numerical analysis, 34th edition, Krishna publishers.
- Kandasamy, P. (2009): Numerical Methods, 4th edition S. Chand & Sons.
- 3. Sastry, S.S. (2007): Introductory method of numerical analysis, 4th edition, Prentice Hall of India.

ALLIED II – PRACTICAL (Based on Allied II papers I and II) (YPGA4)

Credits : 2

(3 hrs/week)

- **Objective :** To train the students to have an exposure in writing a programming language.
- NOTE : Record 10 Marks, Practical Examination 40 marks Duration of the Examination: Three hours. Two questions have to be set with internal choice, one from each unit. Each carries 20 marks.

Write and test run the program in C++ for the following problems.

UNIT : I

- 1. Find the Mean and Median of ungrouped data.
- 2. Find the Mean and Standard Deviation of ungrouped data.
- 3. Form the frequency distribution with k classes given N observations with k known.
- 4. Find the Skewness and Kurtosis of an empirical distribution.
- 5. Regression and correlation coefficients.
- 6. Counting number of words in a given sequence, palindrome.
- 7. Generation of Fibonacci series.

UNIT :2

- 1. Matrix addition and subtractions.
- 2. Matrix multiplication.
- 3. Inverse of a square matrix and solution of simultaneous equations.
- 4. Fitting of Binomial and Poisson distribution for the given frequency distribution and test the goodness of fit.
- 5. Single and two sample 't' test , paired 't' test given a set of n observations.
- 6. F-test for testing the equality of two population variances given a set of n observations.
- Numerical integration by Trapezoidal, Simpson's 1/3 and 3/8th rule Solution of polynomial equations by Newton Raphson method.

MAJOR PAPER V **TESTING STATISTICAL HYPOTHESES** (STMAE) (5 hrs/week)

Credits: 4

Objective : To explain the parametric and non-parametric tests with illustrative examples.

UNIT 1:

Testing of Hypothesis - Neymann-Pearson theory; Statistical Hypothesis - Simple and composite hypothesis, Null and alternative Hypothesis, Two types of errors, critical region, power of a test, Most powerful test – Neymann-Pearson lemma. Simple problems.

UNIT 2:

Uniformly most powerful tests – Likelihood ratio tests – Tests based on t, Chi-Square, F and normal distributions.

UNIT 3:

Sequential Probability Ratio Test – Definition and properties of SPRT, OC and ASN for Binomial, Poisson & Normal distributions - simple problems.

UNIT 4:

Non-Parametric tests – sign test, Wilcoxon signed rank test, Median test, Mann-Whitney U test, Run test, Kolmogorov-Smirnov one sample and two sample tests and Kruskal-Wallis test.

UNIT 5:

Basic ideas on decision theory – Loss functions – Risk functions– Prior and posterior distributions – Baye's Risk - simple problems based on Bayes' estimation.

- 1. Daniel, W.W. (2005): A foundation for Analysis in health Sciences, John Wiley and Sons.
- 2. Gupta, S.C and Kapoor, V.K. (2002): Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd. New Delhi.
- **3.** Hogg, R.V. and Craig, A.T. (1972): Introduction to Mathematical Statistics, third edition, Academic Press, USA.
- 4. Rohatagi, V.K. (1976): An Introduction to Probability and Statistics, John Wiley & Sons. (for unit 5- Section 8.8 only)

- 1. Beaumont, G.P. (1980): Intermediate mathematical Statistics, Chapman and Hall, New York.
- 2. Gibbons, J. D. (1971): Nonparametric Statistical inference, McGraw-Hill Kogakusha ltd., New Delhi.
- 3. Goon, A.M., Gupta, M.K. and Dasgupta, B.(1980): An outline of Statistical theory, Volume I, 6th revised edition, World Press limited, Calcutta.
- 4. Mood, A.M., Graybill, F.A. and Boes, D.C. (1974): Introduction to the theory of statistics, International student edition, McGraw Hill.
- 5. Surendran and Saxena : Statistical inference.
- 6. Wilks, S.S. : Mathematical Statistics

MAJOR PAPER VI DESIGN OF EXPERIMENTS (STMAF)

Credits : 4

(5 hrs/week)

Objective : To enable students to understand the principles of design and analysis of experiments.

<u>UNIT 1:</u>

Principles of Experimentation: Replication, Randomization and Local Control; Size of experimental unit; Methods of determination of experimental units – Maximum curvature methods - Fairfield Smith's variance law.

<u>UNIT 2:</u>

Analysis of Variance – one-way, two-way classification (without interaction); Multiple range tests – Newman-Keuls test, Least significance difference test, Duncan's multiple range test & Tukey's test; Transformations – Square root, angular and log transformations.

<u>UNIT 3:</u>

Completely Randomized design (CRD) and its analysis; Randomized Block Design (RBD) and its analysis; analysis of RBD with more than one but equal number of observations per cell; Latin Square Design (LSD) and its analysis.

<u>UNIT 4:</u>

Missing plot technique – Meaning, Least square method of estimating (one /two) missing observations in RBD and LSD; Analysis of covariance technique in CRD and in RBD with least square estimates only.

<u>UNIT 5:</u>

Factorial experiments – Definition of 2^2 , 2^3 and 3^2 factorial experiments and their analysis; Principles of confounding – Partial and Complete confounding in 2^3 design; Split plot design in RBD layout and its analysis.

- 1. Dass, M.N. and Giri, N.C. (1986): Design and Analysis of Experiments, Wiley Eastern, New Delhi.
- 2. Federer, W.T. (1955): Experimental Design, Oxford & IBH publishing Co., New Delhi.
- 3. Gupta, S.C. and Kapoor, V.K. (2008): Fundamentals of Applied Statistics, Sultan Chand & Sons Pvt. Ltd., New Delhi.

- 1. Montgomery, D.C. (2005): Design and Analysis of Experiments, 5th edition, John Wiley and Sons inc.
- 2. Mukhopadhyay, P. (2005): Applied Statistics, Books and allied pvt ltd., Kolkata

MAJOR PAPER VII APPLIED STATISTICS (STMAG)

Credits : 4

(5 hrs/week)

Objective : To discuss the applications of statistical tools in business and economics.

<u>UNIT 1:</u>

Time series – Concept – Components of time Series – Additive and multiplicative models – Measurement of trend – Moving average method – Least square method.

<u>UNIT 2:</u>

Measurement of seasonal variations – Simple average method – Ratio to trend method – Ratio to moving average method – Link relative method – Variate Difference method

<u>UNIT 3:</u>

Index Numbers – uses, classification of index numbers – Problems in the construction of index numbers – Methods of constructing index numbers – Unweighted index numbers – weighted index numbers, quantity index numbers and cost of living index numbers.

Fixed and chain base index numbers- base shifting, splicing and deflating of index numbers – Optimum test for index numbers – Time reversal test – factor reversal test.

<u>UNIT 4:</u>

Business forecasting – role of forecasting in Business – steps in forecasting – methods of forecasting – business barometers, extrapolation, regression analysis, econometric models, forecasting by the use of time series analysis, opinion polling, causal models, exponential smoothing, survey method. Box-Jenkins methodology – steps only.

<u>UNIT 5:</u>

Official Statistics: Statistical System in India CSO, NSSO and National Statistical Commission (NSC) and its functions – Present structure of the Indian statistical system – Functions of a statistical system – Agricultural statistics – Industrial statistics – Trade statistics – Labour statistics – transport and Communication statistics.

- 1. Gupta, S.P (1999): Statistical Methods, Sultan Chand, New Delhi.
- 2. Kapoor, V.K and Gupta, S. C (2008): Fundamentals of Applied statistics, Sultan Chand & Sons, New Delhi.

- 1. Agarwal, B.L. (1988): Basic Statistics, Wiley Eastern Ltd. New Delhi.
- 2. Croxton, F.E and Cowden, D.J (1984): Applied general statistics, Prentice Hall of India.
- 3. Hanke, J.E. and Wichern, D.W. (2007): Business Forecasting, eighth edition, Pearson education, Asia.
- 4. Website-www.mospi.nic.in

MAJOR PAPER VIII VISUAL BASIC

Credits : 4

(STMH) (4T+3P = 7 hrs/week)

Objective : To train the students to have exposure for programming language.

<u>UNIT 1:</u>

Introduction to object oriented programming – GUI – Client-Server computing (Introduction only). Form, Tool Box, Project and Property windows – Forms and Controls – Creating forms and using controls – setting properties of controls – List and combo boxes – Add item, Remove Item and Clear methods – List Index and List Count properties – Columns and Multiselect properties – Tab Order, Tab Index and Tab Stop properties – Predefined Dialog boxes – Input Box, Msg Box statement and Msg Box function.

<u>UNIT 2:</u>

Programming – Structure of Visual Basic application – Events and event-driven procedures – Event-driven versus Traditional programming – Coding procedures in events – data types – constants, variables and their scope – expressions and assignment – mathematical and string built-in functions – If and Select case structures – Do and For loops – Exit statement – Date Time, Empty and Null values – Passing arguments by value and reference – Arrays – dynamic arrays – user defined data types – Symbolic constants.

<u>UNIT 3:</u>

Objects and instances – object variables and their declaration – scope and lifetime – Generic and specific types – control object types – New and Me keywords – objects assignment – determining Type Of objects – multiple instances of objects.

MDI applications – creating MDI forms and Child forms – Menu and Toolbar.

UNIT 4:

Mouse events – Mouse Up, Mouse Down and Mouse Move methods – Drag and Drop – Drag Over, Drag Icon and Drag Mode – concepts of Grid control. Displaying and Printing – Font properties and settings – TAB and FORMAT – Print method – Text Height and Text Width methods – Current X and Current Y properties – Print Form method. Key board events – Key Down, Key Press and Key Up events and the associated methods.

UNIT5:

Programs for simple statistical problems: Mean, Variance, Correlation Coefficient and Regression Coefficients – Evaluating discrete probabilities – Finding minimum, maximum, range and median of discrete values, sorting and binary search algorithms – Lagrange's interpolation.

BOOKS FOR STUDY:

- 1. Azam, M. (2006): Programming with Visual Basic 6.0, Vikas publishing house.
- 2. Content Development Group (2007): Visual basic programming, Tata McGraw Hill.
- 3. Cornell, G. (2008): Visual Basic 6, Tata McGraw-Hill, U.S.A.

BOOK FOR REFERENCE:

1. Evangelos Petroutsos (1997): Mastering Visual Basic 5, BPB Publications, New Delhi.

CORE ELECTIVE- I DEMOGRAPHY AND ACTUARIAL STATISTICS (ESTA)

Credits : 5

(5 hrs/week)

Objective : To familiarize students with the concepts of Vital statistics. To enable students to understand the Actuarial concepts.

UNIT 1:

Sources of demographic data – civil registration – Population census – population register – errors in demographic data – methods of improvement. Fertility and mortality measurements – General and specific rates – standardized rates – age pyramid and sex composition – Gross and net reproduction rates. Simple Problems.

<u>UNIT 2:</u>

Life table – Structure – Construction – Relationship between the function of a life table – Abridged life table – Population estimation – Growth rates – Gross and net reproduction rate – Component method of population projection – Force of mortality – Gompertz and Makeham's law – logistic curve fitting and its uses. Simple Problems.

<u>UNIT 3:</u>

Elements of compound interest (nominal and effective rate of interest; annuities certain; present values; accumulated amounts; deferred annuities). The functions included in compound interest and their uses. Redemption of Loans, Sinking Funds. The average Yield on the Life Fund of an insurance office. Simple Problems.

<u>UNIT 4:</u>

Premiums; general principles, natural premiums, office premiums, loading for expenses with and without profit premiums, adequacy of premiums, relative consistency. Simple Problems.

<u>UNIT 5:</u>

Policy values, retrospective and prospective methods; Surplus – sources of surplus, principle methods of surplus.

NOTE: Numerical problems can be asked in the question paper.

- 1. Dixit, S.P., Modi, C.S., Joshi, R.V.(2000): Mathematical Basis of life Assurance, IC-81 (Published by Insurance Institute of India, Bombay - 400001).
- 2. Frank Ayers, J.R. (1983): Theory and problems of mathematics of finance, Schaum's outline series, McGraw-Hill book company, Singapore.
- 3. Gupta, S.C and Kapoor, V.K. (2008): Fundamentals of Applied Statistics, Sultan Chand & Sons Pvt. Ltd. New Delhi.

- 1. Goon, A.M. Gupta, M.K. and Dasgupta, B. (1980): An outline of Statistical theory, Vol. II, 6th revised ed., World Press limited, Calcutta.
- 2. Srivastava, O.S. (1983): A text book of Demography, Vikas Publishing society. Supplement to Federation of Insurance Institutes Study Courses F.I.21 (Published by Federation of Insurance Institutes, Bombay).
- 3. Zima, P. and Brown, R.L. (2005): Theory and problems of mathematics of finance, 2nd edition, Tata McGraw Hill .

MAJOR PRACTICAL III (COMPUTER BASED)

Credits: 3

STA5 (3 hrs/week)

Objective: To impart programming skills using VB.

NOTE:

Maximum 50 marks Internal marks: 20 & External Marks: 30 Duration of Examination: Three Hours.

Candidates to answer any TWO questions with internal choice

All questions carry equal marks.

(Outline of the exercises to be carried out)

- 1. Summary Statistics (raw data).
- 2. Correlation and regression.
- 3. Small sample tests of significance.
- 4. Drawing a random sample from uniform, exponential and cauchy population
- 5. Simple database based programs: Names and Telephone Numbers, Students Marks, Electricity Bill, Pay-Slip
- 6. Finding minimum, maximum, range and median for discrete values.
- 7. Lagrange's interpolation.
- 8. Binary search algorithms.

MAJOR PAPER IX SAMPLING TECHNIQUES (STMI)

Credits : 4

(5 hrs/week)

Objective : To introduce various sampling Designs and develop problem solving Skills for comparing the efficiencies of different sampling designs.

<u>UNIT 1:</u>

Design – Organization and execution of sample surveys – principal steps in sample survey – Pilot survey – principles of sample survey – sampling and non-sampling errors – advantages of sampling over complete census – limitations of sampling.

<u>UNIT 2:</u>

Sampling from finite population – simple random sampling with and without replacement – unbiased estimate of the mean, variance of the estimate of the mean, finite population correction – estimation of standard error from a sample – determination of sample size

<u>UNIT 3:</u>

Stratified random sampling – properties of the estimates - unbiased estimates of the mean and variance of the estimates of the mean-optimum and proportional allocations – relative precision of a stratified sampling and simple random sampling – estimation of gain in precision in stratified sampling.

<u>UNIT 4:</u>

Systematic sampling – estimate of mean and variance of the estimated mean – comparison of simple and stratified with systematic random sampling

<u>UNIT 5:</u>

Ratio estimators: Definition – bias – variance of the ratio estimator – Comparison with mean per unit. Difference estimator – Regression estimator: Comparison with mean per unit. PPS sampling – concept only – cumulative method and Lahiri method.

- 1. Cochran, W.G. (1984): Sampling techniques, Wiley Eastern Ltd.
- 2. Daroga Singh, & Chaudhary, F.S. (1986): Theory and Analysis of Sample Survey Designs, Wiley Eastern.
- 3. Mukhopadhyay, P. (2005): Theory and methods of Survey Sampling, Prentice - Hall of India, New Delhi.

- 1. Des Raj (1976): Sampling theory, Tata McGraw Hill. Kapoor, V.K. & Gupta, S.C. (2008): Fundamentals of Applied Statistics, Sultan Chand and Sons.
- 2. Murthy, M.N. (1967): Sampling theory and methods, Statistical Publishing Society, Calcutta.
- 3. Sampath, S. (2000): Sampling theory and methods, Narosa Publishing House
- 4. Sukhatme, P.V. *et al* (1984): Sample survey methods and its applications, Indian Society of Agricultural Statistics, New Delhi.

MAJOR PAPER X STATISTICAL QUALITY CONTROL AND RELIABILITY (STMJ)

Credits : 4

(5 hrs/week)

Objective : To provide the basic knowledge of quality control techniques and reliability concepts.

<u>UNIT 1:</u>

Need for Statistical Quality Control techniques in Industry – Causes of Quality variation – control charts – Use of the Shewhart – control chart – Specification and tolerance limits – 3sigma limits – warning limits – application of theory of runs in quality control – Introduction to 6σ concepts.

UNIT 2:

Control chart for variables: \overline{X} chart – R chart – purpose, construction and their interpretation.

Control chart for attributes: p chart – np chart – c chart – Construction and their interpretation.

<u>UNIT 3:</u>

Acceptance sampling plans for attributes: Producer's risk and consumer's risk –concepts of AQL, LTPD, AOQ, AOQL, ATI and ASN – single sampling plan and double sampling plans – OC, ASN, AOQ, ATI curves for single and double sampling plans.

<u>UNIT 4:</u>

Variable sampling plans- Sigma known and sigma unknown - determination of n and k for one-sided specification – OC curve.

Sequential sampling plan – Sequential Probability Ratio Test – OC, ASN function- working rule – binomial population only.

UNIT 5:

Reliability: Concepts of reliability – hazard rate – MTTF – Bath tub curve – Failure time distribution – Exponential and Wiebull distributions – Reliability of series , parallel and standby systems.

- 1. Gupta, R.C. (2003): Statistical Quality Control, Khanna Publication, New Delhi.
- 2. Kapoor, V.K. and Gupta, S.C. (2007): Fundamentals of applied statistics, Sultan Chand & Sons.
- 3. Mahajan, M. (1994): Statistical Quality Control.
- 4. Veerarajan T.(2003): Probability, Statistics and Random Processes, Second edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi.

- 1. Grant, E.L. and Leavenworth, R.S.(1988): Statistical Quality Control, 6th edition, McGraw Hill.
- 2. Montgomery, D.C. (1983): Introduction to Statistical Quality Control, Wiley Eastern.

MAJOR PAPER XI REGRESSION ANALYSIS (STMK)

Credits : 4

(5 hrs/week)

Objective : To introduce regression models applicable to real life situation.

<u>UNIT 1:</u>

Partial and multiple correlation coefficients-plane of regressionproperties of residuals- relationship among simple, multiple and partial correlation coefficients.

UNIT 2:

Simple linear regression model: Description of the data model – estimation and test of hypothesis – index of fit – predicted values and standard errors – evaluation of fit – analysis of residuals.

<u>UNIT 3:</u>

Effect of outliers in simple regression – model, adequacy and residual plots – deletion of data points – transformation of variables – transformation to achieve linearity – transformation to stabilize variance – removal of heterogeneity – principles of weighted least squares.

<u>UNIT 4:</u>

General linear model: Description of the Data model – properties of least squares estimators – predicted values and standard errors in multiple regression – generalized least squares.

<u>UNIT 5:</u>

Inference on GLM: Test of hypothesis on the linear model – Assumption about the explanatory variable – testing a subset of regression coefficient equals to zero – testing of equality of regression coefficients.

- 1. Kapoor, V.K. & Gupta, S.C. (2007): Fundamentals of mathematical statistics, Sultan Chand and Sons
- 2. Montgomery, D. C., Peck, E. A. and Vining, G. G. (2003): Introduction to linear regression analysis, third edition, John Wiley and Sons, Inc.

- 1. Draper, N.R. and Smith, H. (2003): Applied Regression Analysis, third edition, John Wiley and Sons, Inc.
- 2. Johnston, J. (1984): Econometric methods, third edition, McGraw-Hill International.

MAJOR PAPER XII OPERATIONS RESEARCH

(STML)

Credits : 4

(5 hrs/week)

Objective : Training the students to use optimization techniques for solving decision making problems.

<u>UNIT 1:</u>

Introduction to OR- Linear programming problem – Formulation of LPP – Solving the LPP by graphical method – Solving the LPP by simplex method (degeneracy), Big M & two phase methods - Duality – Concept only - Simple problems.

<u>UNIT 2:</u>

Transportation problem - obtaining initial, feasible and optimal solution by MODI method, degeneracy, Unbalanced transportation problem; Assignment problem - unbalanced assignment problem - Traveling salesman problem.

<u>UNIT 3:</u>

Sequencing - 'n' jobs through 2 machines, 'n' jobs through 3 machines, 'n' jobs on m machines, two jobs on 'm' machines.

Game Theory – Two person zero sum games, the maximin & minimax principle, Mixed strategies, Graphical solution of 2xn and nx2 games, Dominance property.

<u>UNIT 4:</u>

Network analysis by CPM / PERT: Basic concepts – constraints in Network – construction of the network – Time calculations – Concepts of slack and float in network – Finding optimum project duration and minimum project cost

<u>UNIT 5:</u>

Replacement – Introduction – Replacement of equipment/asset that deteriorates gradually – Replacement policy when value of money does not change with time – Replacement policy when value of money changes with time – Replacement of equipment that fails suddenly – Individual replacement policy – group replacement policy.

- 1. Kanthi Swarup, Gupta, P.K. and Manmohan (2003): Operations Reasearch . Sultan Chand & Sons
- 2. Taha, H.A. (2006): Operations Research, 7th edition, Collier MacMillan.

- 1. Hillier, F.S. and Liberman, G.J. (1980): Introduction to operations research, 3rd ed.
- 2. Sundaresan, V., Ganapathy Subramanian, K.S. and Ganesan, K. (2000): Resource Management Techniques, A.R. Publications, Tamil Nadu.

CORE ELECTIVE II PRACTICAL USING SPSS (ESTB)

Credits : 5

(5 hrs/week)

Objective : To orient the students to do data analysis using SPSS.

- 1. Diagrams Simple bar, Pie diagram, Multiple bar diagram(clustered), Subdivided (stacked bar).
- 2. Frequency distribution Univariate (categorical data, quantitative data), Bivarate (cross tabulation).
- 3. Graphs Histogram, Box- Whiskers plot.
- 4. Measures of location, dispersion, skewness and kurtosis raw data, continuous data.
- 5. Harmonic mean and geometric mean.
- 6. Correlation coefficient and scatter diagram both Karl-Pearson's and spearman's rank correlation.
- 7. Regression equations.
- 8. One sample t-test.
- 9. paired t-test (repeated measures t-test).
- 10. Two independent samples t-test.
- 11. Chi-square goodness of fit (one way Chi-square test).
- 12. Chi-square test for independent samples (two way Chi-square test).
- 13.ANOVA one way and two way.
- 14.Mann Whitney signed-U test.
- 15. Wilcoxon signed rank test.

BOOKS FOR STUDY:

- 1. George, D. and Mallery, P. (2006): SPSS for windows step by step 6th edition. Version 13.0, Pearson Education.
- 2. Pal, N. and Sarkar, S. (2005): Statistics- Concepts and applications, Prentice Hall India.

- 1. Clifford E. Lunneborg (2000): Data analysis by Resampling: concepts and applications, Duxbury Thompson learning, Australia.
- **2.** Jeremy J. Foster (2001): Data Analysis using SPSS for Windows. New Edition. Versions 8-10. Sage publications. London.

CORE ELECTIVE III STOCHASTIC PROCESSES

Credits : 5

(ESTC) (5 hrs/week)

Objective : To expose the students to the applicability of various aspects of Stochastic Processes.

<u>UNIT 1:</u>

Definition of stochastic process, classification of stochastic process according to time parameter space and state space-examples of stochastic process

UNIT 2:

Markov chain – definitions and examples – higher transition probabilities – Chapman – Kolmogorov equations(discrete) – classification of states of Markov Chains, Stationary distributions (concept and applications only), examples of Markov Chains

<u>UNIT 3:</u>

Poisson process – Properties of Poisson process - Poisson process & related distributions – birth – death processes – simple examples Yule-Furry process – linear growth process.

<u>UNIT 4:</u>

Renewal process: Definition and examples – Renewal function, renewal density and renewal equation.

<u>UNIT 5:</u>

Simple queuing models M/M/1, M/M/s queuing systems (finite and infinite) steady state solution-simple problems with finite and infinite capacities.

- 1. Medhi, J. (2007): Stochastic Process, New age International, 2nd edition chapter 6(sections 6.2,6.3 only), chapter10 10.1,10.2 (omit 10.2.2.2), 10.4 (sections10.4.1,10.4.2only).
- 2. Veerarajan, T.(2003): Probability, Statistics and Random Processes, Second edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

- 1. Hoel, P.G., Port, S.C. and Stone, C.J. (1991): Introduction to Stochastic Processes.
- 2. Karlin, S. and Taylor, H.M. (1975): A Fist course in Stochastic Processes, Academic Press, New York.
- 3. Ross, S.M. (1983): Stochastic Processes, John Wiley and Sons, New York.

MAJOR PRACTICAL - IV (Calculator based)

(STA6)

Credits: 2

(3 hrs/week)

Objective: To enhance computing skills.

NOTE:

Maximum: 50 marks

Internal marks: 20 & External Marks: 30

Duration of Examination: Three Hours.

Five Questions are to be set without omitting any topic.

Candidates are to answer any three questions without omitting any topic.

All questions carry equal marks. (Outline of the exercises to be carried out)

UNIT 1:

Testing Statistical Hypotheses:

- 1. Type I and Type II error calculations Binomial, Poisson & Normal distributions.
- 2. Most Powerful tests Bernoulli, Poisson & Normal distributions.
- 3. Power Curves Binomial, Poisson & Normal distributions.
- 4. Nonparametric tests sign test, Wilcoxon signed rank test, median test, Mann-Whitney test, run test, Kolmogorov-Smirnov one sample and two sample tests and Kruskal-Wallis test.

UNIT 2:

Design of Experiments:

- 1. ANOVA one & two way classification,
- 2. Analysis of CRD, RBD, LSD, their efficiencies, Missing plot techniques in RBD & LSD.
- 3. Analysis of covariance one-way classification with one concomitant variable.
- 4. Analysis of factorial experiments -2^2 , 2^3 , with and without confounding and 3^2 factorial experiments.
- 5. Analysis of Split plot design in RBD layout

UNIT 3:

Applied Statistics:

- 1. Fitting of trend polynomials by method of least squares linear, quadratic, exponential.
- 2. Methods of measuring trend semi averages, moving average.
- 3. Measurement of seasonal variation simple average, ratio to trend, ratio to moving average and link relative methods.
- 4. Measurement of random component variate difference method.
- 5. Construction of Index numbers Laspeyre's, Paasche's, Bowley's, Fisher's and Marshall-Edgeworth index numbers
- 6. Fixed and Chain base index numbers, Cost of living numbers.
- 7. Base shifting, splicing and deflating of index numbers.

UNIT 4:

Statistical quality control:

- 1. Control charts for attributes and variables-x-bar, R-chart, p, np, and C-charts.
- 2. OC, AOQ, ATI curves for single sampling plan.

Regression Analysis:

- 1. Multiple and Partial correlation coefficient.
- 2. 10.Simple Linear regression model.

UNIT 5:

Sampling:

- 1. Simple random sampling with and without replacement-estimation of population mean and variance
- 2. Stratified random sampling-estimation of mean and variance under proportional allocation and optimum allocation, gain due to stratification
- 3. Systematic sampling-estimation of mean and variance.
- 4. Ratio estimation-estimation for population mean and total based on simple random sampling only.
- 5. Regression method of estimation-estimation for population mean and total (simple random sampling only)
- 6. Probability proportional to size sampling-cumulative total method, Lahiri's method.
- 7. Sample size determination.

Note: Question paper to be set for 100 marks (scaled down to 30)

ALLIED II – PAPER I MATHEMATICAL STATISTICS – I (YSTAA)

Credits : 4

(5 hrs/week)

Objective : To introduce the basic statistical concepts.

<u>UNIT 1:</u>

Concept of sample space – Events, definition of Probability (classical, statistical & axiomatic) – addition and multiplication law of probability –independence – conditional probability – Bayes' theorem simple problems

UNIT 2:

Random variables – discrete and continuous – distribution function – joint probability function – marginal and conditional distributions – independent random variables - simple problems

<u>UNIT 3:</u>

Mathematical Expectation – addition and multiplication theorem – moments – Moment generating function – Characteristic function – Cumulants – their properties. Chebychev's inequality - simple problems

<u>UNIT 4:</u>

Correlation and regression – Rank correlation coefficient - simple problems.

<u>UNIT 5:</u>

Standard Distributions – Binomial, Poisson, Normal and Uniform distributions – Gamma and Beta distributions. Interrelationship between distributions.

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

- 1. Arora, S. and Bansilal, (1989): New mathematical Statistics, Meerat Publications, Satya Prakashan, New Delhi
- 2. Hogg, R.V., McKean, J. W. and Craig, A.T. (2006): Introduction to Mathematical Statistics, Sixth Edition, Pearson education, India.

ALLIED II – PAPER II MATHEMATICAL STATISTICS – II (YSTAB)

Credits : 4

(5 hrs/week)

Objective : To introduce the basics concepts of statistical inference.

<u>UNIT 1:</u>

Exact sampling distribution : Chi square – definition – derivation of pdf, mgf, additive property.t and F – definition – derivation of pdf's – mean and variance. Interrelationship between t, F and chi-square.

<u>UNIT 2:</u>

Point estimation – properties of estimators – Neyman Fisher Factorization theorem, Rao-Blackwell theorem – Cramer-Rao inequality.

<u>UNIT 3:</u>

Methods of estimation – maximum likelihood, moments. Interval estimation – Confidence Interval for proportion(s), mean(s), variance and ratio of variance based on Normal, t, Chi-square and F.

<u>UNIT 4:</u>

Test of significance – Standard Error – Large sample tests. Exact test based on t, Chi-square and F distribution with respect to population mean, proportion, variance and correlation coefficient. Theory of attributes – Test of independence of attributes based on contingency table – Goodness of fit tests based on Chi-square.

<u>UNIT 5:</u>

Test of hypothesis : Type I and Type II errors – power of test – Neymann Pearson Lemma – most powerful test – (statement and result only) - simple problems.

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

- 1. Arora, S. and Bansilal (1989): New mathematical Statistics, Meerat Publications, Satya Prakashan, New Delhi.
- 2. Hogg, R.V., McKean, J. W. and Craig, A.T. (2006): Introduction to Mathematical Statistics, Sixth Edition, Pearson education, India.

PRACTICALS FOR ALLIED MATHEMATICAL STATISTICS I & II (YST2) (3 hrs/week)

Credits : 2

Objective : To familiarize the students with applications of statistical tools.

NOTE : Use of scientific calculators may be permitted for Mathematical Statistics practical examination . Statistical and Mathematical tables are to be provided to the students at the examination hall.

Record of practical: 10 marks

Practical Exam: 40 Marks

- 1. Construction of univariate and bivariate distributions with samples of size not exceeding 200.
- 2. Diagrammatic and graphical representation of data and frequency distribution.
- 3. Cumulative frequency distribution Ogives Lorenz curve.
- 4. Measure of location and dispersion(absolute and relative).
- 5. Fitting of Binomial, Poisson and Normal distributions and tests of goodness of fit.
- 6. Curve fitting by the method of least squares.
 (i) y=ax+b (ii) y=ax²+bx+c (iii) y=ae^{bx}
- 7. Computation of correlation coefficient and regression lines for raw and grouped data. Rank correlation coefficient.
- 8. Asymptotic and exact tests of significance with regard to population proportion(s), mean(s), variance, ratio of variances and coefficient of correlation.
- 9. Confidence Interval based on Normal, t, F and Chi-square statistic.

ALLIED II – PAPER I STATISTICAL METHODS AND THEIR APPLICATIONS – I (YSMAA)

Credits : 4

(5 hrs/week)

Objective : To introduce the basic concepts in Statistics.

<u>UNIT 1:</u>

Nature and scope of statistical methods and their limitations – Classification, tabulation and diagrammatic representation of various type of statistical data – Frequency curve and Ogives – graphical determination of percentiles, quantiles and their uses, Lorenz curve.

<u>UNIT 2 :</u>

Measures of location – arithmetic mean, median, mode, geometric mean, harmonic mean and their properties – merits and demerits - simple problems.

<u>UNIT 3:</u>

Measures of dispersion-Range, mean deviation, quartile deviation, standard deviation, coefficient of variation, skewness and kurtosis - simple problems.

UNIT 4:

Probability of an event – addition and multiplication theorem for two events – Independence of events – conditional probability – Bayes' theorem - simple problems.

<u>UNIT 5:</u>

Concept of random variable – mathematical expectation – moments of random variables (raw and central moments) – Moment generating function - simple problems. Standard distributions: Binomial, Poisson – mean and variance, Normal distribution – properties - simple problems.

- 1. Gupta, S.P. (2005): Statistical Methods, Sultan Chand and Sons.
- 2. Pillai, R.S.N. and Bagavathi, V. (2003): Statistics, S. Chand and Company Ltd., New Delhi.

- 1. Hogg, R.V., McKean, J. W. and Craig, A.T. (2006): Introduction to Mathematical Statistics, Sixth Edition, Pearson education, India.
- Goon, A.M., Gupta, M.K. and Dasgupta, B. (1980): An outline of Statistical theory Vol. I, 6th revised edition, World Press.

ALLIED PAPER - II STATISTICAL METHODS AND THEIR APPLICATIONS – II (YSMAB)

Credits : 4

(5 hrs/week)

Objective : The emphasis is solely upon the applicational understanding and practice of statistical methods.

<u>UNIT 1:</u>

Correlation – Scatter diagram – Rank correlation coefficient – Regression lines – linear prediction – Curve fitting by the method of least squares $(y=ax+b, y=ax^2+bx+c, y=ae^{bx})$ - simple problems.

<u>UNIT 2:</u>

Concept of sampling distribution – standard error – test of significance – large sample tests - simple problems.

<u>UNIT 3:</u>

Test of significance based on t, Chi-square and F distributions with respect to mean, variance and correlation coefficient – Test of independence in contingency table – Test of goodness of fit (Binomial, Poisson, Normal) - simple problems.

<u>UNIT 4:</u>

Sampling from finite population – Simple random sampling, Stratified and Systematic random sampling procedures – Estimation of mean and total and their S.E. – Concept of sampling and non sampling errors.

<u>UNIT 5:</u>

Principle of scientific experiments – Randomization, replication and local control. Basic designs – CRD, RBD, LSD (layout and ANOVA table).

- 1. Gupta, S.P. (2005): Statistical Methods, Sultanchand and Sons.
- 2. Pillai, R.S.N and Bagavathi, V. (2003): Statistics. S.Chand and Company Ltd. New Delhi.

- 1. Hogg, R.V., McKean, J. W. and Craig, A.T. (2006): Introduction to Mathematical Statistics, Sixth Edition, Pearson education, India.
- 2. Goon, A.M., Gupta, M.K. and Dasgupta, B. (1980): An outline of Statistical theory Volume I, 6th revised edition, World Press.

PRACTICALS FOR ALLIED STATISTICAL METHODS AND THEIR APPLICATIONS I & II (YSM2)

Credits : 2

(3 hrs/week)

- **Objective :** To enhance computing skills by analyzing data using various statistical techniques.
- **NOTE** : Use of scientific calculators may be permitted for Statistical methods and their applications practical examination. Statistical and Mathematical tables are to be provided to the students at the examination hall.

Record of practical: 10 marks

Practical Exam: 40 Marks

- 1. Construction of univariate and bivariate frequency distributions with samples of size not exceeding 200.
- 2. Diagrammatic and graphical representation of various statistical data and frequency distributions.
- 3. Cumulative frequency distribution Ogives & Lorenz curve.
- 4. Computation of various measures of location, dispersion (absolute and relative), moments, skewness and kurtosis.
- 5. Curve fitting by the method of least squares:

(i)y=ax+b (ii)y=ax²+bx+c (iii)y=ae^{bx}

- 6. Computation of correlation coefficient and regression lines for raw and grouped data. Rank correlation coefficient.
- 7. Fitting of Binomial, Poisson and Normal distributions and tests of goodness of fit.
- 8. Large sample tests
- 9. Exact tests of significance based on t, Chi-square and F distributions with regard to population proportion(s), mean(s), variance and coefficient of correlation.
- 10. Analysis of CRD, RBD and LSD.

NON - MAJOR ELECTIVE – I

ELEMENTS OF ACTUARIAL STATISTICS (NST1)

Credits : 2

(2 hrs/week)

Objective : To impart basic concepts in actuarial studies.

<u>UNIT 1:</u>

Simple interest – compound interest, Nominal and effective rate of interest – annuities – types of annuities – present value and accumulated value.

<u>UNIT 2:</u>

Premiums – net and gross premiums – natural premiums – level annual premium – adequacy and consistency of premiums.

<u>UNIT 3:</u>

Redemption of loans – amortization method – sinking fund method – redemption of bonds.

BOOKS FOR STUDY :

- 1. Dixit, S.P., Modi, C.S. and Joshi, R.V.(2000): Mathematical Basis of life Assurance, IC-81 (Published by Insurance Institute of India, Bombay).
- 2. Zima, P. and Brown, R.L. (2005): Theory and problems of mathematics of finance, II edition, Tata McGraw Hill .

NON – MAJOR ELECTIVE II

MARKETING RESEARCH (NST2)

Credits : 2

(2 hrs/week)

Objective : To introduce statistical concepts in marketing research.

<u>UNIT 1:</u>

Market research – Nature & scope, process & problem identification, frame work . Data availability and collection procedures – secondary and commercial data, primary data and questionnaire construction.

<u>UNIT 2:</u>

Qualitative techniques of data collection – scaling techniques – sampling decisions.

<u>UNIT 3:</u>

Univariate data analysis – parametric and nonparametric tests.

BOOKS FOR STUDY :

- 1. Gupta, S.P. (1999): Statistical Methods, Sultan Chand, New Delhi.
- Majumdar. R. (2005): Marketing Research, New Age International (P) Ltd.