M.A./M.Sc. STATISTICS SYLLABUS w.e.f. 2014

Semester –I:

Course No.	Title of the Course	Credit	Lecture L	T	P
STM-CR-101	Probability and Distribution Theory - I	4	4	1	-
STM-CR-102	Sample Surveys and Statistics for National Development	4	4	1	-
STM-CR-103	Statistical Computing-A	4	4	1	-
STM-EA-104	Mathematical Analysis	4	4	1	-
STM- EA-105	Time Series Analysis	4	4	1	-
STM-EA-106	Practical based on Courses STM-CR-101 & STM-CR-102	4	-	-	2
STM-EA-107	Practical based on Courses STM-CR-103, & STM-EA-104/STM-EA-105	4	-	-	2
STM-EO-108	Statistical Methods	4	4	1	-

General Instructions for the Candidates

1. The two years (4 semester) PG Programmes is of 96 credit weightage i.e. 24 credits/semester (24×4 = 96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has a choice to opt for any 12 credits (3 papers) out of minimum of 16 credits (4 papers) offered as Elective (Allied), except for a particular semester as mentioned by the Department where a candidate is required to gain a minimum of 4 credits (1 paper) form elective (Open) offered by any other Department/Faculty.
4. A candidate has compulsorily to obtain a minimum of 4 credits (1 paper) from Elective (Open) from outside the parent Department in any of the semesters.
5. A candidate can earn more than the minimum required credits (i.e. more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

Semester-II:

Course No.	Title of the Course	Credit	Lecture L T P
STM-CR-201	Probability and Distribution Theory - II	4	4 1 -
STM-CR-202	Linear Models and Regression Analysis	4	4 1 -
STM-CR-203	Statistical Computing-B	4	4 1 -
STM-EA-204	Stochastic Processes	4	4 1 -
STM-EA-205	Demography	4	4 1 -
STM-EA-206	Actuarial Statistics	4	4 1 -
STM-EA-207	Practical based on Courses STM-CR-201 and STM-CR-202	4	- - 2
STM-EA-208	Practical based on Courses STM-CR-203, STM-EA-204 , STM-EA- 205 & STM-EA-206	4	- - 2
STM-EO-209	Sampling Theory & Design of Experiments	4	4 1 -

General Instructions for the Candidates

1. The two years (4 semester) PG Programmes is of 96 credit weightage i.e. 24 credits/semester (24×4 = 96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has a choice to opt for any 12 credits (3 papers) out of minimum of 16 credits (4 papers) offered as Elective (Allied), except for a particular semester as mentioned by the Department where a candidate is required to gain a minimum of 4 credits (1 paper) form elective (Open) offered by any other Department/Faculty.
4. A candidate has compulsorily to obtain a minimum of 4 credits (1 paper) from Elective (Open) from outside the parent Department in any of the semesters.
5. A candidate can earn more than the minimum required credits (i.e. more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

Semester-III :

Course No.	Title of the Course	Credit	Lecture L	T	P
STM-CR-301	Multivariate Analysis	4	4	1	-
STM-CR-302	Operations Research – I	4	4	1	-
STM-CR-303	Inference –I	4	4	1	-
STM-EA-304	Design and Analysis of Experiments	4	4	1	-
STM-EA-305	Bayesian Analysis	4	4	1	-
STM-EA-306	Practical based on Courses STM-CR-301 and STM-CR-302	4	-	-	2
STM-EA-307	Practical based on Courses STM-CR-303 ,STM-EA-304 & STM- EA-305	4	-	-	2
STM-EO-308	Data Analysis using Softwares	4	4	1	-

General Instructions for the Candidates

1. The two years (4 semester) PG Programmes is of 96 credit weightage i.e. 24 credits/semester (24×4 = 96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has a choice to opt for any 12 credits (3 papers) out of minimum of 16 credits (4 papers) offered as Elective (Allied), except for a particular semester as mentioned by the Department where a candidate is required to gain a minimum of 4 credits (1 paper) form elective (Open) offered by any other Department/Faculty.
4. A candidate has compulsorily to obtain a minimum of 4 credits (1 paper) from Elective (Open) from outside the parent Department in any of the semesters.
5. A candidate can earn more than the minimum required credits (i.e. more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

Semester-IV:

Course No.	Title of the Course	Credit	Lecture L	T	P
STM-CR-401	Operations Research – II	4	4	1	-
STM-CR-402	Industrial statistics and Reliability Theory	4	4	1	-
STM-CR-403	Sample Survey Project	4	4	1	-
STM-EA-404	Inference –II	4	4	1	-
STM-EA-405	Information Theory	4	4	1	-
STM-EA-406	Econometrics	4	4	1	-
STM-EA-407	Practical based on Courses STM-CR-401,STM-CR-402, STM-EA-404 & STM-EA-406	4	-	-	2
STM-EO-408	Testing of hypothesis using Softwares	4	-	-	2

General Instructions for the Candidates

1. The two years (4 semester) PG Programmes is of 96 credit weightage i.e. 24 credits/semester (24×4 = 96).
2. A candidate has compulsorily to opt for 12 credits from the core component in each semester.
3. A candidate has a choice to opt for any 12 credits (3 papers) out of minimum of 16 credits (4 papers) offered as Elective (Allied), except for a particular semester as mentioned by the Department where a candidate is required to gain a minimum of 4 credits (1 paper) form elective (Open) offered by any other Department/Faculty.
4. A candidate has compulsorily to obtain a minimum of 4 credits (1 paper) from Elective (Open) from outside the parent Department in any of the semesters.
5. A candidate can earn more than the minimum required credits (i.e. more than 96 credits for four semester programme) which shall be counted towards the final result of the candidate.

PROBABILITY AND DISTRIBUTION THEORY -I

COURSE NO: STM-CR-101 M.M.80

UNIT-I

Class of sets, fields, sigma fields, minimal sigma field, and Borel sigma field. Definition of probability: classical and relative frequency approach, Discrete probability space, properties of probability based on axiomatic approach, Independence of events, conditional probability, total and compound probability rules. Bayes theorem and its applications. Random variable. Cumulative distribution function of random variables and its properties, probability function of a random variable.

UNIT-II

Joint distribution function and probability function of a random variable. Expectation of a random variable and its properties, conditional expectation, covariance and correlation. Moments, measure of location and dispersion of a random variable. Moment generating function, probability-generating function, Characteristic function of a real and vector valued random variables. Inversion formula, and Uniqueness theorem.

UNIT-III

Standard Univariate discrete distributions: Discrete Uniform, Bernoulli, Binomial, Poisson, Negative Binomial, Geometric, Hyper geometric and their properties and applications. Marginal and conditional distributions, Distribution of functions of discrete random variables, reproductive property of standard distributions.

UNIT-IV

Univariate Continuous distributions: Uniform, Beta, Gamma, Exponential, Pareto, Weibull, Laplace, Normal, Cauchy and their properties and applications. Marginal and conditional distributions.

TEXT BOOKS:

Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition

Rohatgi, V.K. (1994): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Rao, R.C. (1973): Linear Statistical Inference and its Applications, 2/e, Wiley Eastern.

REFERENCES:

Pitman. (1993): Probability, Narosa Publishing House.

Johnson, S.and Kotz, (1972): Distribution in Statistics, vol. I, II and III, Houghton And Miffin.

Johnson, Kotz and Kemp (1992): Univariate discrete distribution, John Wiley

Cramer, H. (1946): Mathematical Methods of Statistics, Princeton.

SAMPLE SURVEY & STATISTICS FOR NATIONAL DEVELOPMENT

Course No: STM-CR-102 M.M.80

UNIT I

Simple Random Sampling: Concept of sampling design, expected value and sampling variance of the sample mean, expected value of the sample mean square and estimation of the variance. Determination of sample size. Simple random sampling as applied to qualitative characteristics.Stratified random Sampling: Estimation of the population mean/total and its variance, choice of sample sizes in different strata, variance under different allocations. Comparison with unstratified sampling. Estimation of the gain in precision due to stratification, construction of strata.

UNIT II

Ratio and Regression methods of Estimation: Variance of the estimates, estimation of variances, optimum property of ratio and regression estimator. Ratio and regression estimator in stratified random sampling. Some modifications of ratio and regression estimators. Comparison among regression, ratio and simple unbiased estimates. Unbiased ratio type estimates.

UNIT III

Systematic Sampling: Sample mean and its variances. Comparison of systematic with simple random and stratified sampling in the general case and also in the case of linear trend.

Cluster sampling: Estimation of mean and its variance for equal and unequal clusters. Efficiency in terms of intra-class correlation. Optimum unit of sampling. Sampling with replacement and unequal probabilities. Estimation of mean and its variance.

UNIT-IV

Double Sampling: Double Sampling for Stratification including estimation of variance. Variance of ratio and regression estimates in double sampling. Double sampling for pps estimation. Sampling on successive occasions: Sampling on two occasions, estimation of current population mean.

Two-stage sampling: (a) Equal first stage unit; estimation of population mean and its variance and estimates of variance. Comparison with one stage sampling

(b) Unequal first stage unit; estimation of population mean. Expected values and variance of different estimates including the case of probability proportional to size

Economic Development: Growth in per capita income and distributive justice. Indices of development, Human development indexes. Estimation of national income. Population growth in developing and developed countries. Population projection using Leslie matrix. Labour force projection measuring inequality in income, Gini coefficient, their measure. Poverty measurement.

TEXT BOOKS:

Cochran, W. G: Sampling Techniques, 3rd edition, Wiley.
Mukhopadhyay, P. (2000): Theory and Methods of Survey Sampling, Prentice Hall of India, Private limited, New Delhi
Des Raj & Chandak(1998): Sampling Theory, Narosa.
Murthy, M. N. (1977): Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
Skate teal (1984): Sampling Theory of Surveys with Applications, Iowa State University Press, & IARS.
Singh, D and Chuddar, F. S. (1986): Theory and Analysis of Sample Survey Design, New Age International Publisher.
CSO (1980): National Account Statistics, Source and Health.
Keyfitz, N. (1977): Applied Mathematical Demography, Springer Verlag.
Sen, A (1997): Poverty and Inequality
UNESCO: Principal for Vital Statistics System, Series M-12.

STATISTICAL COMPUTING-A

Course No.: STM-CR-103 **M.M-80**

UNIT I

Programming in FORTRAN: Character codes, constants, Variable names (Real, Integer, Double Precision, Complex and logical); arithmetic, logical and relational operators, Expressions: Arithmetic, Character; Relation and Logical expressions, Rules for writing arithmetic expressions. Statements:

UNIT-II

Specification of Data, Format types, one dimensional Array Statements, Two-dimensional and multi dimensional Arrays Assignment Statement, Format Specifications. Control Statements: Do Loops, Do-Continue, IF-Blocks, Unconditional GOTO, IF (condition) GOTO Label, and Computer GOTO Statement, STOP, RETURN and END statements, COMMON Statement.

UNIT III

Built-in-Functions, User Defined Functions, Function Subprograms, Subroutine Subprograms. Writing programs for statistical calculation Addition, subtraction and multiplication of matrices,correlation, regression, t-test, chi square test, r x c contingency table. Analysis of variance (CRD, RBD, LSD)

UNIT IV

Statistical Softwares: Working with Software Package MINITAB for graphics, descriptive statistics, representation of multivariate data, simple hypothesis tests (t,χ^2 and F, analysis of variance, and linear regression and matrix processing (Basic operations, Eigen Values and inversion of Matrices etc.)

Mathematical Analysis

Course No.: STM-EA-104 **Max. Marks: 80**

UNIT-I

Algebra of Matrices, trace of a matrix, trace of AB = trace of BA, Wiellandt's Theorem as a simple consequence. Inverse of partitioned matrices, idempotent and nilpotent matrices, linear independence and dependence of row (column) vectors, orthogonal and unitary matrices, Gram-Schmidt orthogonalisation. Linear equations, solutions of homogenous and non-homogenous equations, basic linear transformation, eigen values and eigen vectors of a matrix and their determination. Quadratic forms. Necessary and sufficient condition for a quadratic form to be positive definite.

UNIT-II

Real Analysis: Finite, countable and uncountable sets, bounded and unbounded sets, Archimedean property, ordered field, completeness of R, sequence and series of functions, limit sup. and limit inf. of a bounded sequence, continuity, uniform continuity, the algebra of continuous functions, monotonic functions, types of discontinuities, infinite limits and limits at infinity. Differentiability, Rolle's Theorem, Mean Value Theorems and Uniform Convergence.

UNIT-III

Reimann Integration: Definition and existence of a Reimann integral for bounded functions, refinement of partition, behavior of the lower and upper sums under refinement of a partition. Necessary and sufficient conditions for integrability. Integrability of sum, difference, product and quotient of two integrable functions, the integral as a limit of sum. Some integrable functions. Integration and Differentiation, the Fundamental Theorem of integral calculus.

UNIT-IV

Complex Analysis: Complex numbers, Algebra of complex numbers, Analytic functions, Cayuchy-Reimann equations, line integral, Cauchy's Theorem, Cauchy's integral formula, power series, exponential, logarithm, sine and cosine functions.

TEXT BOOKS:

Apostol, T.M (1985), Mathematical Analysis, Narosa, India Ed.
Courant, R.and John, F.(1965), Introduction to Calculus and Analysis, Wiley.
S.C.Malik, Mathematical Analysis, New Age International Limited.
Miller, K.S(1975)Advanced Real Calculus, Harper, New York.
Rudin, Walter(1976). Principles of Mathematical Ananlysis, McGraw Hill.
Grabill, Walter(1976). Matrices with Applications in Statistics, 2nd Ed.Wadsworth.
Roa,C.R.(1973), Linear Statistical Inference and its Applications, 2nd Ed.John Wiley and Sons,Inc.
Searel, S.R.(1982).Matrix Algebra useful for Statistics. John Wiely and Sons,Inc.

STM-EA-105: Time Series Analysis:

UNIT-I

Time-series as discrete parameter stochastic process, auto covariance and autocorrelation functions and their properties.

Exploratory time series analysis, tests for trend and seasonality, exponential and moving average smoothing. Holt and Winters smoothing, forecasting based on smoothing.

UNIT-II

Detailed study of the stationary processes: (1) moving average (MA), (2) auto regressive (AR), (3) ARMA and (4) AR integrated MA (ARIMA) models. Box-Jenkins models, choice of AR and MA periods.

UNIT-III

Discussion (without proof) of estimation of mean, auto covariance and autocorrelation functions under large sample theory, estimation of ARIMA model parameters.

UNIT-IV

Spectral analysis of weakly stationary process, peridogram and correlogram analysis, computations based on Fourier transform.

References:

Box, G.E.P. and Jenkins, G.M. (1976) Time series analysis-Forecasting and Control, Holden-day, san Francisco.

Andersonj, T.W. (1971): The Statistical Analysis of Time series, Wiley, N.Y.

Statistical Methods

COURSE NO: STM-EO-108

UNIT-I

Elective for student of other programmes:

Descriptive Statistics: Measures of central tendency (Arithmetic mean , Geometric mean, Harmonic mean, Median, Mode) its properties and applications, Graphical location of the measure of central tendency, Characteristic for an ideal measure of dispersion, Measure of dispersion, Co-efficient of dispersions, Skewness and kurtosis for the study of nature of data.

UNIT-II

Bivariate distribution, Scatter diagram, Karl Pearson Coefficient of correlation, Rank correlation, Repeated rank correlation, Correlation coefficient for a bivariate frequency distribution, correlation ratio, multiple and partial correlations, Regression, Lines of regression, regression curves, Regression co-efficient, Fitting of regression lines.

UNIT-III

Random variable, Probability mass function, Probability density function, Important Statistical Discrete distributions: Bernoulli, Binomial, Poisson, hypergeometric, negative binomial, uniform, multinomial, their mean and variances, Recurrence relations.

UNIT-IV

Important statistical Continuous distributions: normal distribution as a limiting form of binomial distributions , Moments of normal distribution, uniform distribution and their moments, exponential and Gamma distributions, their mean and variances, Particular cases.

TEXT BOOKS:

S.C. Gupta & V.K Kapoor (2012), Fundamentals of Mathematical Statistics, Sultan Chand & Sons,

Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition

PROBABILITY AND DISTRIBUTION THEORY-II

COURSE NO: STM-CR-201 M.M.80

UNIT-I

Sampling distributions. Chi-square and F distributions and their properties and applications, Non-central F and Chi-square distribution. Test of significance of F and Chi-square.

UNIT-II

Sampling distributions. t distribution and its properties and applications, Non-central t distribution. Test of significance of t.

Bivariate distributions: Bivariate normal distribution,exponential and multinomial distributions and their properties , marginal and conditional distributions. Expectations and conditional expectations, covariance.

UNIT-III

Bivariate discrete distributions. Power series distributions and Generalized power series distribution and its properties, relations and applications.

Order Statistics: Distribution and properties. Joint and marginal distributions of order statistics. Distribution of median and range. Discrete order statistics and their joint pmf. Limiting distribution of nth order statistics. Extreme value laws and their properties. Correlation between extremes.

UNIT-IV

Convergence: Convergence of a sequence of random variables, convergence in probability, almost sure, Convergence of a sequence of pair of random variables. Convergence of moments, Helly-Bray theorem, Continuity theorem Borel Cantelli Lemma and convolution of distributions. Convergence of a series of random variables.

Chebyshev's and Kintchine's weak law of large numbers (WLLNs). Condition for the WLLNs. Strong law of large number and Kalmogrov's theorems and examples.

CLT: Introduction of CLT. Lindberg Levy , Liapunov forms and De-Movier's central limit theorems (CLT) and examples.

TEXT BOOKS:

Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition

Rohatgi, V.K. (1994): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

Rao, R.C. (1973): Linear Statistical Inference and its Applications, 2/e, Wiley Eastern

Ash, Robert. (1972): Real Analysis and Probability, Academic Process

Dudley, R.M. (1989): Real Analysis and Probability, Wads worth and Brooks /Cole

REFERENCES:

Pitman, J. (1993): Probability,Narosa Publishing House.

Johnson, S.and Kotz, (1972): Distributions in Statistics, vol. III, Houghton and I, II And Miffin.

Johnson, Kotz and Kemp (1992): Univariate discrete distribution, John Willy

LINEAR MODELS & REGRESSION ANALYSIS

STM-CR-202 **M.M.80**

UNIT-I:

Linear models; Gauss Markov set up, Model classification, Normal equations and least squares estimates, Error and estimation space, Variance and covariance of least square estimates, Estimation of error variance, estimation with correlated observations, least square estimates with restriction on parameters.

UNIT-II

Test of hypotheses for one and more than one linear parametric functions, Tests of linear hypotheses, estimable linear hypotheses, Generalized F test, Generalized t test, Multiple comparison test due to Tukey and Schaffer.

UNIT-III

Experimental Design models; Introduction, Point estimation, Re-parameterization, Variance and Covariance of estimable function, Testing of hypotheses, Regression models.

UNIT-1V

Simple linear regression fit of polynomials, Residual and their plot as tests for departure from assumption such as fitness of model, normality, and homogeneity of variances and detection of outliers

TEXT BOOKS:

Cookers. and Weisberg, S (1982). Residual and Influence in Regression. Chapman and Hall

Draper,N.R. and Smith, R.L. (1998). Applied Regression Analysis. 3rd Ed. Wiley.

Gunst, R.F. and Mason, R.L. (1980). Regression Analysis and its Applications- A Data Oriented Approach. Marcel and Decker.

Roa, C.R. (1973). Linear Statistical Inference and its Applications. Wiley Eastern.

Weisberg, S. (1985). Applied Linear Regression. Wiley

STATISTICAL COMPUTING-B

STM-CR-203 **M.M.80**

Unit I

Introduction to object oriented programming, concept and designing: numerical constants and variables, integer: int, short, long, signed and unsigned, floating point: float and double. Strings: character data type, input and output of strings.

Unit II

Control statements: relation operators, compound statement, if, if else, while loop, for loop, do while loop, logical operators, switch and break statement. Array: array variable, syntax rules for arrays, multiple subscripts in arrays, for loops with arrays,

Unit III

Functions: defining and using functions. Function declaration, array in function, global, local and static variable. Pointers: pointers data type, pointers and address, pointers and arrays, pointers to functions, pointer to pointer. **Writing program for statistical calculation Addition, subtraction and multiplication of matrices,correlation, regression, t-test, chi square test,**

r x c contingency table. Analysis of variance (CRD, RBD, LSD)

Unit IV

Statistical Softwares: Working with Software Package S-PLUS for graphics, descriptive statistics, representation of multivariate data, simple hypothesis tests (t,χ^2 and F, analysis of variance, and linear regression and matrix processing (Basic operations, Eigen Values and inversion of Matrices etc.)

References

1. R. Decker and S. Hirshfield (1998). The object concept: an introduction to computer programming using c++, PWS publishing.

2. S.B. Lipmann and J. Lajoie (1998). C++ primer. Third ED. Addison Wesley.

3. W.J. Savitch (2001). Problem solving with c++. The object of programming. Third ED. Addison Wesley, Longman.

STOCHASTIC PROCESSES

Course No.: STM-EA-204 **M.M.80**

UNIT I

Introduction to Stochastic Processes (SP's); Classification of Stochastic Processes according to state space and time domain. Definition of Markov Chain and examples. Countable state Markov chains (MC's), Chapman-Kolmogrov equations; Calculation of n-step transition probability and its limit.

UNIT II

Stationary distribution, Classification of states: persistent state, transient state and ergodic state, examples, limiting theorems concerning states; Simple Random Walk Model and gambler's ruin problem; expected duration of the game, Probability of ruin at the nth trail. And Probability of a draw at the rth trial.

UNIT III

Markov Process with Discrete state space: Poisson processes, Poisson processes and related distributions, Birth and death process; Markov Process with Continuous state space, Brownian Motion, Wiener Process, Differential equations for a Wiener Process, Kolmogorov Equations.

UNIT IV

Introduction of Branching process: Galton-Watson branching process, properties of generating functions of branching process and distribution of population size, Calculation of moments of Branching Process and distribution of total progeny. Probability of ultimate extinction, numerical illustrations.

TEXT BOOKS:

Medhi, J. (1982): Stochastic Processes, Holden-Day.

Baily, N.T.J. (1965): The Elements of Stochastic Processes: John Wiley

Jagers P. (1974): Branching Processes with Biological Applications, Wiley.

Harris, T.E. (1963): The Theory of Branching Processes, Springer-Verlag.

Hoel, P.G., Port, S.C. and Stone, C.J (1972): Introduction to Stochastic Processes, Houghton Miffin & Co.

Karlin, S. and Taylor, H.M. (1975): A First Course in Stochastic Processes, Vol.1, And Academic Press.

Basu, A.K. (2003): Introduction to Stochastic Processes, Narosa

DEMOGRAPHY

COURSE NO: STM-EA-205 **M.M.80**

UNIT I

Introduction and Definition of vital Statistics, Coverage and content errors in demographic data use of balancing equations, Chanderasekharan-Deming formula to check completeness of registration data. Accuracy of age data on sex and age: Whipple's, Myer's and UN indices. Dependency ratio.

UNIT II

Measure of fertility; relationship between CBR, GFR and TFR. Mathematical models on fertility and human reproduction process, distributions of time to first birth, inter-live birth intervals and of number of births (for both homogeneous and non-homogeneous group of women), estimation of parameters; estimation of parity progression ratios from open birth interval data.

Unit III

Mortality: concepts and rates; measures of infant mortality rate. Force of mortality. Life table and its construction: Complete and abridged. Greville's and Reed-Merrels methods. Relationship between life table functions and their estimation. Relationship between abridged life table functions.

Unit IV

Population projection: Methods for population projection. Use of Leslie matrix. Frejka's component method. Models for population growth and their fitting to population data.

Migration: concepts and rates. Uses of place of birth and duration of residence data. Estimation of measure of mobility.

TEXT BOOKS:

Bartholomew, D.J. (1982). Stochastic Models for Social Processes, John Wiley.

Benjamin, B. (1969). Demographic Analysis, George, Allen and Unwin.

Ching, C. L. (1968). Introduction to Stochastic process in Biostatistics, John Wiley.

Cox. P. R. (1970). Demography, Cambridge University Press

Keyfitz, N. (1977). Applied Mathematical Demography, Springer Verlag.

Spiegelman, M. (1969). Introduction to Demographic Analysis; Harvard University Press.

Wolfenden, H. H. (1954). Population Statistics and their Compilation; Americian Actuarial Society.

STM-EA-206: Actuarial Statistics

UNIT-I

Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curtate future lifetime, force of mortality.

Life table and its relation with survival function, examples, assumptions for fractional ages, some analytical laws of mortality, select and ultimate tables.

UNIT-II

Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions evaluation for special mortality laws.

UNIT-III

Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations.

Distribution of aggregate claims, compound Poisson distribution and its applications. Distribution of aggregate claims, compound Poisson distribution and its applications.

Principles of compound interest: Nominal and effective rates of interest and discount, force of interest and discount, compound interest, accumulation factor, continuous compounding.

UNIT-IV

Life insurance: Insurance payable at the moment of death and at the end of the year of death-level benefit insurance, endowment insurance, deferred insurance and varying benefit insurance, recursions, commutation functions.

Life annuities: Single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, commutation functions, varying annuities, recursions, complete annuities.

Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportionable premiums, commutation functions, accumulation type benefits.

A brief outline of payment premiums and net premiums.

References:

1. N.L. Bowers, H.U. Gerber, J.C. Hickman, D.A. Jones and C.J. Nesbitt (1966), Actuarial Mathematics, Society of Actuarials, Ithaca (1997).
2. Neill, A. (1977): Life Contingencies, Heinemann

Sampling Theory & Design of Experiments

COURSE NO: **STM-EO-209**

UNIT-I

Basic concepts of sampling from a finite population; sampling versus complete enumeration; simple random sampling with replacement and without replacement, Concept of sampling design, expected value and sampling variance of the sample mean, expected value of the sample mean square and estimation of the variance.

UNIT-II

Determination of sample size. Simple random sampling as applied to qualitative characteristics. Stratified random Sampling: Estimation of the population mean/total and its variance, choice of sample sizes in different strata, variance under different allocations. Comparison with unstratified sampling. Estimation of the gain in precision due to stratification, construction of strata. Systematic sampling; cluster sampling and multi-stage sampling.

UNIT-III

Analysis of variance techniques: Design of experiments, Principles of Design of experiments (randomization, replication, local control) Assumptions, layout and Analysis of Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD), missing plot (one observation) techniques for RBD and LSD.

UNIT-IV

Factorial experiments: General factorial experiments, factorial effects; Main effects and Interactions. best estimates and testing the significance of factorial effects; study of 2 and 3 factorial experiments in randomized blocks; Yates method for computing different factorial effects. complete and partial confounding.

Text Books:

Cochran, W. G: Sampling Techniques, 3rd edition, Wiley.

Mukhopadhyay, P. (2000): Theory and Methods of Survey Sampling, Prentice Hall of India, Private limited, New Delhi

Des Raj & Chandak(1998): Sampling Theory, Narosa.

S.C. Gupta & V.K Kapoor (2010), Fundamentals of Applied Statistics, Sultan Chand & Sons,

MULTIVARIATE ANALYSIS

COURSE NO: STM-CR-301 M.M.80

UNIT-I

Multivariate Normal Distribution Theory: Marginal and conditional distribution, Joint distribution, Linear function of correlated normal variate. Characteristics function of multivariate normal distribution, Maximum likelihood estimation of the mean vector and co-variance matrix and their independence. Distribution of sample mean vector. Large sample behavior of mean vector and co-variance matrix. Distribution of non-central chi-square, Quadratic form and its distribution.

UNIT-II

Multiple and partial correlation co-efficient and their sampling distribution. Simple regression model, regression co-efficient and distribution of sample regression co-efficient. Test of linear hypothesis about regression co-efficients and interval estimation.

Canonical Correlation and Canonical variables: Definition, uses, estimation and statistical inference. Distribution of characteristic roots and vectors: The distribution of canonical Correlation.

UNIT-III

Distribution of sample co-variance matrix and the sample generalized variance; Wishart matrix and its distribution. Some important properties of the Wishart distribution. Characteristic function of Wishart distribution.

Generalized T^2 statistics: The general T^2statistics, Derivation of the generalized T^2 statistics and its distribution. Some important properties of T^2 statistics and its uses. Two-sample problem with unequal co-variance matrices. Likelihood criterion for testing independence of set of variate and it moments. Walk's lambda criterion and its distribution. Mahalanobis D^2 statistics and its distribution.

UNIT-IV

Classification and discrimination: Classification and discrimination procedure for discrimination between two multivariate normal populations. Sample discriminant function, tests associated with discriminate function, standards of good classification, probability of misclassification and their estimation, classification into two and more than two multivariate normal population

Principal Component: Definition of principal components, uses, estimation and computation, Statistical inference on principal components.

Factor Analysis: Definition of factor analysis and uses, linear factor models, estimation of factor loading, Factor rotation, estimation of factor scores.

TEXT BOOKS:

Anderson, T.W (1983): An Introduction to Multivariate Statistical analysis, 2nd ed., John Wiley

Johnson, R.A. and Wichen, D.W. (1992): Applied Multivariate Statistical Analysis,2nd ed. Prentice Hall.

Giri, N.C. (1977): Multivariate Statistical Inference, Academic press.

Kshirsagar, A. M (1972): Multivariate Analysis, Marcel Decker.

Morrison, D. F. (1976): Multivariate Statistical Methods, 2nd Ed, and McGraw Hill.

Sharma, S. (1996): Applied multivariate technique, Wiley

Muirhead, R. J. (1982): Aspects of multivariate statistical theory, John Wiley.

Seber, G.A.F.(1984): Multivariate observations, Wiley.

Srivastava, M.S.and Khatri, C.G. (1979): An introduction to multivariate statistics. North Holland.

Carter and Srivastava: Multivariate Analysis, North Holland.

OPERATIONS RESEARCH I

Course No: STM-CR-302 **M.M.80**

UNIT I:

Definition and scope of Operational research, Necessity of Operations Research in Industry; phases in Operations Research. **LP problems: Simplex method and Extreme point theorems; Revised Simplex Method, Transportation and Assignment Problems with their methods of solution,**

UNIT II

Duality in LPP, Symmetric and asymmetric dual problems, duality theorems, Primal-Dual Relations, Complementary Slackness Theorem and Complementary Slackness conditions, Dual Simplex Method, Sensitivity Analysis and Parametric Programming,

UNIT III

Decision Making in the face of competition, two–person, Zero sum games, **Games with mixed strategies**, existence of solution and uniqueness of value in zero-sum games, finding solutions in **2x2, 2xm and mxn games, Equivalence between game theory and linear programming problem.**

UNIT IV

Sequencing and scheduling problems, 2 machine n-job and 3 machine n-job problems with identical machine sequence for all jobs; 2-job n-machine problem with different routings. Project management; PERT and CPM; Probability of project completion, PERT-crashing.

TEXT BOOKS :

Taha H.A. (1982) Operational Research: An introduction; Macmillan.
Philips D.T., Ravindran A. and Solberg J. Operation Research, Principles and Practice.
Kanti Swarup, P.K. and Singh,M.M.. (1985) Operation Research; Sultan Chand & Sons.

REFERENCES:

Hillier F.S. and Lieberman G.J. (1962) Introduction to Operation Research; Holden Day.
Saaty T.L. (1961) Elements of Queuing Theory with Applications; McGraw Hill.
Churchman C.W, Ackoff R.L. and Arnoff E.L. (1957) Introduction to Operations Research
R. Panneerselvam(2002): Operations Research: Prentice Hall

INFERENCE - I

COURSE NO: STM-CR-303 M.M.80

UNIT-I

Point Estimation: The general statistical decision problem, Example (Point estimation, Interval estimation etc.). Criteria of unbiasedness, consistency and efficiency. Cramer-Rao Inequality. Minimum variance unbiased (MVU) estimation, UMVU Estimation, Asymptotic relative efficiency, Invariance of consistent estimator under continuous transformation. Chapman Robin's Inequality.

UNIT-II

Sufficient and Complete Statistics: Sufficiency, Minimal sufficient statistic, Factorization theorem, Fisher–Neyman criterian. Characterization of distributations. Admitting Sufficient Statistics. Exponential families and Pitman families, Invariance property of sufficiency under one to one transformation of sample space. Fisher information for one and several parameter models. Rao-Blackwell theorem. Completeness and Lehman –Scheffle theorem.

UNIT-III

Methods of estimation: Method of maximum likelihood (MLE). Optimum properties of MLE. Maximum Consistent Asymptotic Normal estimators (CAN) obtained by MLE method in one parameter exponential family. Other methods of estimation: Moments, Minimum Chi –square, modified minimum Chi –square and least square estimate.

UNIT-IV

Testing of Hypothesis: Concepts of critical regions, test functions, two kinds of errors, size function, power function, level of significance, Most Powerful (MP) and Uniformly most powerful (UMP) test, in class of size tests. Neyman Pearson Lemma, MP tests for simple null against simple alternative hypothesis.

UMP tests for simple null hypothesis against one-sided alternatives and for one-sided null against one-sided alternatives in one parameter exponential family. Extension of these results to distributions with Monotone Likelihood ratio property.

TEXT BOOKS:

Kale, B.K. (1999): A first course on Parametric Inference, Narosa Publishing House.

Rohatgi, V. (1988): An Introduction to Probability and Mathematical Statistics. Wiley Eastern Ltd. New Delhi (Student Edition)

REFERENCES:

Lehman, E.L. (1986): Theory of Point Estimation (Student Edition)

Lehman, E.L. (1986): Testing Statistical Hypothesis (Student Edition)

Rao, C.R. (1973): Linear Statistical Inference

Dudewicz, E.J. and Mishap, S.N. (1988): Modern Mathematical Statistics. Wiley Series in Prob. Math. Stat., John Wiley and Sons, New York (International Student Edition)

Ferguson, T.S. (1967): Mathematical Statistics, Academic.

Zacks,S (1971).Theory of Statistical Inference, John Wiley and Sons, New York.

DESIGN AND ANALYSIS OF EXPERIMENTS

Course No: STM-EA-304 **M.M.80**

UNIT-I

Introduction to basic designs and their analysis, Principles of experimental design.Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD), missing plot techniques for RBD and LSD. Analysis of Covariance for CRD and RBD.

UNIT-II

Introduction to Incomplete block design intra block analysis (estimability), estimates of estimable linear parametric function; Balanced Incomplete Block Design. Intra block analysis, Inter block analysis, recovery of inter block information; Youden design.

UNIT-III

General factorial experiments, factorial effects; best estimates and testing the significance of factorial effects; study of 2 and 3 factorial experiments in randomized blocks; complete and partial confounding. Fractional replication for symmetric factorials. Split plot experiments.

UNIT IV

Biological assays: The structure of Bio assay. Nature of operation, relative potency, Similarity. Dose Response Curve. Fieller Theorem. Types of Bio- Assays: Direct Assays, Indirect Assays based on quantitative responses i) Parallel Line Assays, ii) Slope Ratio Assays. Quantal Response Assays: i) Dragsted-Behren Method, ii) Spearman-Karber Method.

TEXT BOOKS:

Alok dey (1986): Theory of Block Designs, Willey Eastern
Angela Dean Daniel Voss (1999): Design and Analysis of Experiments, Springer.
Das, M.N and Giri, N. (1979): Design and Analysis of Experiments, Willey Eastern
Giri, N (1986): Analysis of Variance, South Asia Publishers
John, P.W.M. (1971): Statistical Design and Analysis of Experiments,
McmillainJoshi.D.D. (1987): Linear estimation and Design of Experiments Willey Eastern
R. Rangaswamy (2005): A Text book of Agricultural Statistics. New Age International (P) Limited.

STM-EA-305: Bayesian Inference

Unit I

Fundamentals of Bayesian Statistics, Conditional probability and its applications in Bayesian analysis, Bayes theorem for events, Bayes factor, Generalized Bayes theorem for events, Bayes theorem for future events, Bayes theorem for random variables, Sequential nature of Bayes theorem.

Unit II

Prior distribution, subjective determination of prior distribution. Improper priors, non-informative priors, invariant priors. Conjugate prior families, construction of conjugate families using sufficient statistics of fixed dimension, mixtures of conjugate priors. Bayes estimation of Binomial, Poisson, exponential & Weibull distributions.

Unit III

The normal model, Normal data with a non informative conjugate and semi conjugate prior distributions. Inference for the mean, conditional on the variance, Joint inference for the mean and variance, Bias, variance and mean squared error, Prior specification based on expectations , The normal model for non-normal data

Unit IV

Large sample inference, Approximations based on posterior modes, methods of maximizing functions, conditional maximization, Newton-Raphson method of maximization, approximation of posterior densities using normal and Laplace's approximation.

References:

1. Berger, J.O. : Statistical Decision Theory and Bayesian Analysis, Springer Verlag.
2. Robert, C.P. and Casella, G.: MonteCarlo Statistical Methods, Springer Verlag.

Data Analysis using MINITAB

COURSE NO: STM-EO-308

UNIT-I

Statistical Software's: MINITAB reading & Manipulation of data, Commands/Statements in MINITAB, Descriptive Statistics, Representation of Multivariate data. Basic operations on matrices.

UNIT-II

Working with Software package MINITAB for graphics, EDA: Histogram, Plot, Box plot, Pi-chart, QQ plot, density plot, Stem and Leaf. Regression analysis: simple and multiple.

UNIT-III

Using MINITAB: Tests of significance, Errors in sampling, Critical region and level of significance, Test of significance of large samples, Test of single proportion, Test of significance of difference of proportions,

UNIT-IV

Using MINITAB: Difference of mean & proportion, Chi-Square test for independence of attributes and Contingency table, t-test, Paired t-test, Test for correlation in sampling from normal population, F-test, testing of two variance of two univariate normal population.

TEXT BOOKS:

1. B. Ryan and B.L. Joiner (2001). MINITAB Handbook, Fourth edition, Duxbury.
2. R.A. Thisted (1988): Elements of Statistical Computing, chapman and Hall.
3. S.C. Gupta & V.K Kapoor (2012), Fundamentals of Mathematical Statistics, Sultan Chand & Sons,
4. Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition.

OPERATIONS RESEACH II

Course No.: STM-CR-401 **M.M.80**

UNIT I

Analytical structure of inventory problems; ABC Analysis: EOQ problem with and without shortages with (a) production is instantaneous (b) Finite Constant rate (c) shortages permitted random models where the demand follows uniform distributing, multistage inventory subject to constraints,

UNIT II

Queuing models-specifications and effectiveness measures. Littles formula, Steady-state solutions M/M/1 and M/M/C models with associated distributions of queue-length and waiting time. M/G/1 queue. Steady-state solutions of M/Ek/1. Transient solution of M/M/1 queue.

UNIT III

Dynamic Programming, Integer Programming-branch and bound algorithm and Gomory's Cutting Plane algorithm. Multi Criterion and Goal Programming.

UNIT IV

Nonlinear programming, Formulation, Lagrange multiplier Technique, KuhnTucker necessary and sufficient conditions for optimality of an NLPP, Quadratic Programming problems, Wolfe's and Beals algorithms for solving quadratic programming problems, Separable Programming.

TEXT BOOKS:

Taha H.A. (1982) Operational Research: An introduction; Macmillan.
Hadley G.(1964) Nonlinear and Dynamic Programming; Addision Wesley.
Kabmboj ,Puri,N,C;Mathematical Programming

REFERENCE BOOKS:

Bazara and Shetty (1979) Nonlinear Programming Theory And Algorithms; John Wiley
Kanti Swarup, P.K. and Singh,M.M.. (1985) Operation Research; Sultan Chand & Sons.
Rios's (1989): Optimization Theory and Applications, Wiley Eastern
Hadley G. and Whitin T.M. (1963) Analysis of Inventory Systems; Prentice Hall.
Hillier F.S. and Lieberman G.J. (1962) Introduction to Operation Research; Holden Day.
Murthy K.G (1976) Linear and Combinatorial Programming; John Wiley.
Kleinrock L. (1975) Queuing Systems Theory Vol.1, John Wiley.
Philips D.T., Ravindran A. and Solberg J. Operation Research, Principles and Practice.
Saaty T.L.(1961) Elements of Queuing Theory with Applications; McGraw Hill.
Churchman C.W, Ackoff R.L. and Arnoff E.L. (1957) Introduction to Operations Research.

INDUSTRIAL STATISTICS & RELIABILITY THEORY

Course No: STM-CR-402 M.M.80

UNIT-I:

Meaning and scope of SQC, Stewarts control chart, Statistical basis of a control chart, control chart for variables (X, R, & S) charts. Control charts for attributes (np, p & C) charts. Operating Characteristic function (OC) and Average Run length (ARL) of X-bar chart. Moving average charts.

UNIT-II:

Consumer and producer's risk, Operating Characteristic curve/function (OC). Corrective Sampling Plan (CSP), Average Sample Number (ASN), Average out-going Quality (AOQ), Graphical method of drawing AOQ, Average out-going Quality Limit (AOQL), Single Sampling Plan, Methods of finding n and c, Double Sampling Inspection Plan, evaluation and design.

UNIT-III:

Sequential Sampling Plan. Plans for Inspection by Variables for one-sided specification.Capability indices Cp, Cpk and Cpm; estimation, confidence intervals relating to capability indices for normally distributed characteristics.

UNIT-IV:

Reliability concepts, hazard rate, distribution of longevity and moments, common life distributions, exponential, Weibull, normal distributions. Type I and Type II censored samples with replacement. Reliability of a system with independent units connected in (a) series and (b) Parallel systems.

TEXT BOOKS:

Barlow, R.E. and Proschan, F. (1985). Statistical Theory of Reliability and Life Testing; Holt, Rinehart and Winston.

Biswas, S.(1996). Statistical Quality Control, Sampling Inspection and Reliability; New Age International Publishers.

Montgomery, D.C. (1985) Introduction to Statistical Quality Control; Wiley

Ott, E.R. (1975) Process Quality Control; McGraw hill

Phadke, M.S. (1989) Quality Engineering through Robust Design; Prentice Hall

Wetherill, G.B. (1977) Sampling Inspection and Quality Control; Halsted Press

Wetherill, G.B.and Brown, D.W Statistical Process Control, Theory and Practice; Chapman and Hall

Sample Survey Project

Course No: STM-CR-403

INFERENCE –II

COURSE NO: STM- EA-404 **M.M.80**

UNIT-I

Likelihood ratio tests: Large sample properties, derivation of common likelihood ratio tests, asymptotic distribution of likelihood ratio test, Consistency of tests.

Uniformly Most Powerful Unbiased Tests, similar tests with Newman structure locally best unbiased tests, type A and A1 critical regions for the exponential family. Randomized test.

UNIT-II

Interval Estimation: Determination of confidence interval based on small and large samples. Relation between confidence estimation and hypothesis testing.

Bayesian Inference: Prior and Posterior distributions, uniform prior, non- informative prior, Jeffery's invariant prior, Natural conjugate prior and improper and invariant prior. Loss function, Bayes risk. Bayesian Point estimation, Bayesian interval estimation.

UNIT-III

Sequential Analysis: Definition of Sequential Probability Ratio Test (SPRT). Fundamental relations among α, β, A and B. Determination of A and B in practice. Wald's fundamental identity and the derivation of O.C and ASN functions. Proof of the ultimate termination of SPRT for simple hypothesis. Examples based on Normal, Poisson, Binomial and Exponential conditions.

UNIT-IV

None Parametric Inference: Introduction, Advantages of none parametric methods over parametric methods. One Sample Problem: Sign Test, Wilcoxon-Signed rank test, Kolmogrove Smirnov Test, ARE, Applications of Pitman's theorem on the calculation of efficiency and ARE for Sign Test.

General Two Sample Problem: Wilcoxon-Mann- Whitney Test, Kolmogrov-Smirnov two sample test (for samples of equal size), Median test, ARE of Mann-Whitney Test. Mood Test, Ansari –Bradlay Test

TEXT BOOKS:

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

Rohatgi, V. (1988): An Introduction to Probability and Mathematical Statistics. Wiley Eastern Ltd. New Delhi (Student Edition)

REFERENCES:

Lehman, E.L. (1986): Theory of Point Estimation (Student Edition)

Lehman, E.L. (1986): Testing Statistical Hypothesis (Student Edition)

Rao, C.R. (1973): Linear Statistical Inference

Dudewicz, E.J. and Mishap, S.N. (1988): Modern Mathematical Statistics. Wiley Series in Prob. Math. Stat., John Wiley and Sons, New York (International Student Edition)

Ferguson, T.S. (1967): Mathematical Statistics, Academic.

Zacks, S (1971). Theory of Statistical Inference, John Wiley and Sons, New York.

Berger, J, O.; Statistical Decision Theory and Bayesian Analysis, Springer Verlag.

Gibbons, J.D. (1985): Non-Parametric Statistical Inference. Marcel Decker.

INFORMATION THEORY

COURSE NO: STM- EA-405 M.M.80

Basic Concepts of Information Theory: Quantitative measure of information, Binary unit of information, measure of uncertainty and its properties, measure of information for two dimensional discrete and continuous finite probability scheme. Measure of mutual information. Shannon's fundamental inequalities. Redundancy, efficiency and channel capacity. Uniqueness of the entropy function, entropy maximization problem.

UNIT-II

Elements of Encoding: Purpose of encoding, separable binary codes, Shannon-Fannon encoding. Condition for noiseless coding. Fundamental theorem of discrete noiseless coding. Huffman's minimum redundancy code. Fundamental theorem of discrete encoding in presence of noise. .

UNIT-III

Entropy under Stochastic Regimes: Finite Markov Chains. Basic theorem on regular Markov chain. Entropy of a simple Markov chain. Entropy of a discrete stationary source. Discrete channels with finite memory. The extension of discrete memoryless noisy channels.

UNIT-IV

Inequalities of Information Theory: Kullback-Leibler measure of information. Mean information for discrimination and divergence and their properties. Fisher information, Information and sufficiency. Minimum discrimination information-sufficient statistics.

TEXT BOOKS:

Reza,F.M.: An Introduction to Information Theory, McGraw Hill

Mathai, A.M. and Rathie,P. N.: Basic Concepts in Information Theory and Statistics, Wiley Eastern.

Ash, R.: Information Theory, Wiley Eastern.

Kullback, S.: Information Theory and Statistics, Dover Publication.

STM-EA-406: Econometrics

UNIT-I

Nature of econometrics, the general linear model (GLM) and its extensions, ordinary least squares (OLS) estimation and prediction, generalized least squares (GLS) estimation and prediction, heteroscedastic disturbances, pure and mixed estimation.

UNIT-II

Auto correlation, is consequences and tests. Theil BLUS procedure, estimation and prediction, muticollinearity problem, its implications and tools for handling the problem, ridge regression.

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

UNIT-III

Simultaneous linear equations model and its generalization, identification problem, restrictions on structural parameters, rank and order conditions.

UNIT-IV

Estimation in simultaneous equations model, recursive systems, 2 SLS estimators, limited information estimators, k-class estimators. 3 SLS estimator, full information maximum likelihood method, prediction and simultaneous confidence intervals.

References:

1. Apte, P.G. (1990): Text books of Econometrics, Tata McGraw Hill.
2. Cramer, J.S. (1971): Empirical Econometrics, North Holland.

Testing of hypothesis using SPSS & R Software's

COURSE NO: STM--EO-408

UNIT-I

Statistical Software: SPSS reading & Manipulation of data, Commands/Statements in SPSS, Descriptive Statistics, Representation of Multivariate data. Working with Software package SPSS for graphics, EDA: Histogram, Plot, Box plot, Pi-chart, QQ plot, density plot, Stem and Leaf. Regression analysis: simple and multiple.

UNIT-II

R Software: Introduction, Types of functions: Data functions, Summary functions, Elementary functions and graphical functions. Commands/Statements in R for descriptive Statistics, representation of Multivariate data, EDA, Histogram, Plot, Box plot, Pi-chart, QQ plot, density plot, Stem and Leaf. Regression analysis: simple and multiple.

UNIT-III

Using SPSS & R Software's: Tests of significance, Errors in sampling, Critical region and level of significance, Test of significance of large samples, Test of single proportion, Test of significance of difference of proportions,

UNIT-IV

Using SPSS & R Software's: Difference of mean & proportion, Chi-Square test for independence of attributes and Contingency table, t-test, Paired t-test, Test for correlation in sampling from normal population, F-test, testing of two variance of two univariate normal population.

TEXT BOOKS:

S.C. Gupta & V.K Kapoor (2012), Fundamentals of Mathematical Statistics, Sultan Chand & Sons,
Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition