DEPARTMENT OF STATISTICS

CLASS: M.Sc.(Statistics)

PROGRAM OUTCOME:

***The program aims to develop statistician who can translate the knowledge in diverse areas.**

***It will be able students to formulate the mathematical/ statistical models for real data set arising in various fields in order to analysis in respect of various useful characteristics of the population.**

*** It aims to evolve ability to critical thinking, scientific attitude, solution oriented approach , process skills like communication, new research technology, awareness about optimum use of resources and practice ethics in life.**

*** It will develop competitive strength for job in diverse sectors of economy.**

*** It aims to develop self employability and entrepreneurship.**

COURSE OUTCOME:

It comprises of (16) sixteen theory courses and four practical courses spread uniformly over four semesters (total two years). Four theory courses and one practical course will be under taken in each semester.

FIRST SEMESTER:

Course – I Probability Theory: The purpose of the course is to develop knowledge of the fundamental probability tools for quantitatively determining the risk. The application of these tools lies in the problems encountered during decision making.

Course – II Statistical Distributions: The objective is to provide detailed knowledge of the characterization of all the useful discrete and continuous distributions.

Course – III Sampling Techniques: The course aims to defining the population under study, its sampling frame, studying various sampling methods, determining the sample size and collecting data.

Course – IV Computer Fundamentals and Programming in C Language: The objective of this course is to introduce a student with basic know how of a computer system and to traine him/her for the middle level computer programming language "C".

SECOND SEMESTER:

Course – V Design of Experiments and Linear Estimation: This course provides background of the fundamental theories and practices of statistical modeling and the analysis of observational, experimental and survey data.

Course – VI Inference – I: Point Estimation and Testing of Hypothesis: The purpose of estimation theory is to arrive at an estimator that exhibits the properties of a good estimator. The estimator takes observed data as an input and produces an estimate of the parameters.

Course – VII Matrices & Linear Difference Equations: This course will enable the students to understand the basic concepts of matrices, their types and their mathematical operations leading to the estimation of parametric models.

Course – VIII Real and Complex Analysis: The object of studying this course is to follow up various properties and important formulae related to real and complex numbers with their proofs.

THIRD SEMESTER:

Course –IX Inference II: Interval Estimation, Sequential Analysis & Non-Parametric Inference: This course provides deepper knowledge of the inferential statistics such as sequential estimation, OC and ASN functions, loss and risk functions, one and two samples non-parametric tests.

Course – X Engineering Statistics, Quality Control and Reliability: The objective of this course is to give the knowledge of various methods to control the process and the quality of products and also to increase the reliability of a device / system.

Course – XI Operation Research I: This course provides the idea for formulating mathematical modeling and their optimum solution in the contest of practical problems belonging to government and private sectors.

Course – XII Stochastic Process & Survival Analysis: The aim of this course is to study the different types of stochastic process, random walk, renewal theory with their wide applicability in social science and management sciences.

FOURTH SEMESTER:

Course – XIII Multivariate Analysis: Due to multidimensional nature of the data arising from the various fields, it is a primary need to infer about multivariate technique such as factor analysis, discriminate analysis, cluster analysis and principal component analysis etc. which are used in reduction, factorization, classification and analysis of high dimensional data.

Course – XIV Economic Statistics and Demography: This course aims to study various models and components of time series analysis for forecasting purposes. It also gives the study of distribution of population with respect to birth, death, aging and migration.

Course – XV Operations Research II: This course is designed to introduce students to idea of various types of programming, sequencing and replacement problem of items that deteriorate with time.

Course – XVI Advanced Experimental Designs: Experimental designs are those by which the knowledge of various statistical topics can be applied in agriculture field for improving the crop-plants through genetic-techniques.

CLASS: B.Sc. (Statistics)

1. PROGRM OUTCOME: Students after having degree in B.Sc. (with statistics) should have knowledge of different concepts and fundamentals of Statistics and ability to apply this knowledge in various industry. They may pursue their future career in the field of statistics and research.

2. COURSE OUTCOME:

It comprises of (08) eight theory courses and (06) six practical courses spread over six semesters (total three years). One theory course and one practical course will be under taken from semester I to IV each and two theories and one practical in V and VI semester each.

FIRST SEMESTER:

Course – I Descriptive Statistics (Univariate) and Theory of Probability: After completing this course a student will have ability to describe data with measures of central tendency and dispersion also the students will develop ability to apply basic probability principals to solve real life problems.

SECOND SEMESTER:

Course – II Descriptive Statistics (Bivariate) and Probability Distributions: This course is designed to understand bivarite quantitative and qualitative data and its analysis with knowledge of several discrete and continuous distributions.

THIRD SEMESTER:

Course – III Theory of Estimation and Sample Survey: After completing this course a student will have ability to understand various probability and non-probability sampling methods. The students will also have the concept of point and interval estimation as well as ability to understand Z, t, F and chi-square distributions.

FOURTH SEMESTER:

Course – IV Testing of Hypothesis and Applied Statistics: After completing this course a student will have knowledge of test of significance (one sample and two samples) and familiarity with different aspect of applied statistics used in real life situations for forecasting.

FIFTH SEMESTER:

Course – V Multivariate Analysis and Non-Parametric Methods: After completing this course a student will have the ability to understand the basic concepts of multivariate distributions and also the ability to apply distribution free tests.

Course – VI Analysis of Variance and Design of Experiment: After completing this course a student will have the concepts of analysis of variance (ANOVA) and also the concept of design of experiment including the factorial experiment.

SIXTH SEMESTER:

Course – VII Statistical Computing and Introduction to Statistical Software: Student will have the basic knowledge of Excel and R programming with some basic notions for developing their own simple programs after completing this course.

Course – VIII Operation Research: After studying operation research the student will have the knowledge of the mathematical tools that are needed to solve optimization problems.

REQUIREMENTS / RECOMMENDATIONS

1. That at least one extra hand (preferably with computer knowledge) be provided to meet out the additional work load created due to increased syllabus and addition of computer course.
2. Each department of statistics be equipped with sufficient number of computers to enable the students to carry out their practical work.
3. Each department of statistics must have one lab. Assistant with knowledge of computers to assist the practical work in lab.
4. Some new topics have been included in the revised syllabus and therefore it is necessary that come sort of training be imparted to the teaching staff probably the form of orientation / refresher courses.
5. Use of electronic calculators is allowed in all theory papers as well as practical exams.
6. Every batch of practical must consist of 20 students.

Unified Syllabus of Statistics

Course	Instructions
B.Sc. Part- I & Part – II	There will be three papers of 3 hours duration of 50 marks in each. Practical will be of 50 marks & three hour duration in each year.
B.A Part- I & Part – II	There shall be two theory papers of three hour duration of 33 marks each. Practical will be of 34 marks & three hour duration in each year.
B.Sc Part-III	There will be three theory papers of three hour duration & 75 marks each. Practical would be of 75 marks & three hour duration.
B.A Part – III	There will be three theory paper of three hour duration & 35 marks each. Practical would be of 45 marks & three hour duration.

UNIFIED SYLLABUS OF STATISTICS
B.Sc. Part- I

Paper I: Statistical Methods:

UNIT-I

Concept of statistical population, Attributes and variables (Discrete and Continuous). Different types of scales – nominal, ordinal, ratio and interval. Primary data – designing a questionnaire and schedule, collection of primary data, checking their consistency. Secondary data, its major sources, scrutiny of data for internal consistency and detection of errors of recording. Presentation of data : classification, tabulation, diagrammatic & graphical representation of grouped data. Frequency distributions, cumulative frequency distributions and their graphical representations, histogram, frequency polygon and ogives. Stem and Leaf plot. Box Plot.

UNIT-II

Measures of central tendency – arithmetic mean, median, mode, harmonic mean, geometric mean – their properties, merits and demerits. Measures of dispersion – range, quartile deviation, mean deviation, standard deviation with their merits and demerits, coefficients of dispersion.

UNIT-III

Moments, Sheppard's correction for moments for grouped data (without derivation). Skewness and Kurtosis and their measures including those based on moments and quartiles.

UNIT-IV

Bivariate data, principles of least squares, fitting of polynomial curves and fitting of curves reducible to polynomial form.

Corrlation and Regression, Spearman's rank correlation. Partial and Multiple correlation and Multiple regression for trivariate data, their measures and related results.

UNIFIED SYLLABUS OF STATISTICS
B.Sc. Part- I

Paper – II : Probability

UNIT – I

Random experiment, trial, sample point and sample space, events, operations of events, concepts of equally likely, mutually exclusive and exhaustive events.

Definition of probability : Classical, relative frequency and axiomatic approaches. Discrete probability space, properties of probability under set theoretic approach. Independence of events, Conditional probability, total and compound probability theorems, Bayes theorem and its applications.

UNIT – II

Random variables – discrete and continuous, probability mass function (pmf) and probability density function (pdf), Cumulative distribution function (cdf). Joint distribution of two random variables, marginal and conditional distributions.

UNIT – III

Independence of random variables. Expectation of a random variable (rv) and its properties., expectation of sum of random variables and product of independent random variables, conditional expectation and related problems.

UNIT – IV

Moments, moment generating function (m.g.f.) & their properties, continuity theorem for m.g.f. (without proof). Cumulants and c.g.f., characteristics function (definition only). Chebyshev's inequality. Weak law of large numbers and Central Limit Theorem for a sequence of independently and identically distributed random variables and their applications (statement only).

UNIFIED SYLLABUS OF STATISTICS
B.Sc. Part- I

Paper – III : Probability distributions and Theory of Attributes

UNIT – I

Discrete univariate distributions : Uniform, Binomial, Poisson, Hypergeometric, Geometric and Negative binomial distributions, fitting of binomial and poisson distributions.

UNIT – II

Continuous univariate distributions : Uniform, Normal, Exponential, Gamma, Beta and Cauchy distributions, fitting of normal distribution.

UNIT – III

Exact sampling distributions : chi-square, t and F with distribution function and their simple properties.

UNIT – IV

Theory of attributes : Notion and terminology, Contingency table, class frequencies, ultimate class frequencies, consistency. Association of attributes, independence, measure of association for 2x2 table, Yule's coefficient of association. Contingency tables.

B.Sc. Part- I

PRACTICAL

The practical examination will be based on papers I, II & III and will cover the following experiments.

List of Practical Experiments

1. Graphical representation of data by Histogram, Frequency polygons, frequency curves and Ogives.
2. Calculation of measures of location.
3. Calculation of measures of dispersion.
4. Calculation of moments, measures of skewness and measures of Kurtosis.
5. Fitting of curves by method of least squares.
6. Determination of regression lines and calculation of correlation coefficient – grouped and ungrouped data.
7. Calculation of multiple and partial correlation coefficients for three variables
8. Calculation of measures of association in contingency tables.
9. Testing independence of attributes in m x n contingency table.
10. Fitting of Binomial, Poisson and Normal distributions to observed data.

REFERENCES:

1. Goon, Gupta and Dasgupta : Fundamentals of Statistics, Vol I. The Worlds Press Pvt. Ltd., Calcutta.
2. Yule, G.U. and Kendall, M.G.: An Introduction to the theory of statistics. Charles Griffin & Company Ltd.
3. Gupta, S.C. and Kapoor, V.K. : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
4. Parzen, E.S. : Modern Probability Theory and Its Applications.
5. Meyer, P.: Introductory Probability and Statistical Applications.
6. Mood A.M., Graybill F.A. and Boes D.C. (1974) : Introduction to the theory of Statistics, McGraw Hill.

UNIFIED SYLLABUS OF STATISTICS
B.Sc. Part- II

Paper I : Statistical Inference

UNIT – I

Point estimation. Characteristics of a good estimator: Unbiasedness, consistency, sufficiency and efficiency. Method of maximum likelihood and properties of maximum likelihood estimators (without proof). Method of minimum Chi-square. Method of Least squares and method of moments for estimation of parameters. Problems and examples.

UNIT – II

Sufficient Statistics, Cramer-Rao inequality and its use in finding MVU estimators. Statistical Hypothesis (simple and composite). Testing of hypothesis. Type I and Type II errors, significance level, power of a test. Definitions of Most Powerful (MP), Uniformly Most Powerful (UMP) and Uniformly Most Powerful Unbiased (UMPU) tests.

UNIT – III

Neyman-Pearson's lemma and its applications for finding most powerful tests for simple hypothesis against simple alternative. Interval estimation – concept of interval estimation confidence interval for mean & variance in case of normal population only.

UNIT-IV

Test of significance – large sample test for proportions and means : (i) single sample, (ii) two independent samples. Tests based on chi-square, t and F distributions.

UNIFIED SYLLABUS OF STATISTICS
B.Sc. Part- II

Paper II : Survey Sampling

UNIT – I

Sampling Method : Concept of population, sample, parameter and statistic, sampling versus census, advantages of sampling methods, role of sampling theory, sampling and non-sampling errors, bias and its effects, probability sampling.

UNIT-II

Simple Random sampling with and without replacement, use of random number tables in selection of simple random sample, estimation of population mean and proportion. Derivation of expression for variance of these estimates. Estimates of variance. Sample size determination.

UNIT-III

Stratified random sampling. Problem of allocation, proportional allocation, optimum allocation. Derivation of the expression for the standard errors of the usual estimators when these allocation are used. Gain in precision due to stratification.

UNIT-IV

Systematic sampling : estimation of population mean and population total, standard errors of these estimators. Cluster sampling with equal clusters. Estimation of population mean and their mean square error.

UNIFIED SYLLABUS OF STATISTICS
B.Sc. Part- II

Paper III : Analysis of Variance and Design of Experiment.

UNIT-I

Analysis of Variance. One way classification. Assumptions regarding model. Two way classification with one observations per cell.

UNIT-II

Principles of Design of experiments: Randomization, Replication and local control. Choice of size and type of a plot using uniformity trials. Completely Randomized Design (CRD), Randomized Block Design (RBD). Concept and definition of efficiency of design. Comparison of efficiency between CRD and RBD.

UNIT – III

Latin Square Design (LSD), Lay-out, ANOVA table, Comparison of efficiencies between LSD and CRD, LSD and RBD.

UNIT-IV

Factorial Experiments : general description of factorial experiments; 2^2, 2^3 and 2^n factorial. Definition of main effects and interactions in 2^2 and 2^3 factorial. Preparation of ANOVA by Yate's procedure. Estimates and tests for main and interaction effects.

B.Sc. Part- II

PRACTICAL

The practical examination will be based on papers I, II and III and will cover the following experiments:

List of Practical Experiments

1. Chi-square test for (i) $\sigma = \sigma_0^2$, (ii) Goodness of fit, (iii) independence of two attributes.
2. t – test for (i) $\mu = \mu_0$ (ii) $\mu_1 = \mu_2$ (iii) $\rho = 0$
3. F-test for $\sigma_1^2 = \sigma_2^2$
4. Large sample tests.
5. ANOVA in one-way and two-way classification.
6. Analysis of LSD.
7. Drawing a simple random sample with the help of table of random numbers.
8. Estimation of population means and variance in simple random sampling.
9. Stratified random sampling for population mean (proportional and optimum allocation).
10. Factorial Experiment Practical.

REFERENCES

1. Hogg & Craig : Mathematical Statistics.
2. Mood, Graybill and Boes : Introduction to the theory of Statistics.
3. Goon, Gupta and Dasgupta : Fundamentals of Statistics, Vol. I and Vol. II
4. Gupta, S.C. and Kapoor, V.K. : Fundamentals of Statistics.
5. Gupta, S.C. and Kapoor, V.K. : Applied Statistics..
6. Cochran, W.G. : Sampling Techniques
7. Cochran and Cox : Experimental Design.
8. Das & Giri : Design and Analysis of Experiments (Wiley Eastern).

UNIFIED SYLLABUS OF STATISTICS
B.A. & B.Sc. Part- III

Paper 1 : Non-parametric Methods and Numerical Analysis

UNIT – I

Non-parametric tests – tests for randomness and test for goodness of fit. One sample tests : sign test, Wilcoxon signed rank test. Two sample tests : run test, Kolmogorov Smirnov's test. Median test and Mann – Whitney U test, Spearman's rank correlation test

UNIT – II

Calculus of finite differences, operators, separation of symbols, examples and problems. Interpolation formulae with remainder term. Newton's forward and backword formulae for equal intervals.

UNIT – III

Central difference formulae, Newton's divided difference formula for interpolation, Lagrange's interpolation formula.

UNIT – IV

Numerical integration : Derivation of general quadrature formula for equidistant ordinates. derivation of Trapezoidal, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules, Weddle's rule. Numerical differentiation using Newton's forward and backward formulae.

UNIFIED SYLLABUS OF STATISTICS
B.A. & B.Sc. Part- III

Paper II : Applied Statistics

UNIT – I

Time series – its different components, illustrations, additive and multiplicative models, determination of trend-graphic, semi-average, least square and moving average methods, measures of seasonal variation-simple average, ratio to moving average, ration to trend, link related method.

UNIT – II

Index number – its definition, application of index number, price relative and quantity or volume relatives, link and chain relative, problem involved in computation of index number, use of averages, simple aggregative and weighted average method. Laspeyre's, Paashe's and Fisher's index number, time and factor reversal tests of index numbers, consumer price index

UNIT – III

Demographic methods : Sources of demographic data – census, register, ad-hoc survey, hospital records, demographic profiles of Indian Censuses. Measurement of mortality, crude death rates, age specific death rates, infant mortality rates. Measurement of fertility – crude birth rate, general fertility rate, age-specific birth rate, total fertility rate, gross and net reproduction rate. Standardized death rates. Complete life table, its main features and construction (Abridged life table).

UNIT – IV

Control charts for variables and attributes. Sampling inspection by attributes – single and double sampling plans. Producer's and consumer's risk, OC, ASN, ATI functions AOQL and LTPD of sampling plans. Sampling inspection by variables – simple cases.

UNIFIED SYLLABUS OF STATISTICS
B.A. & B.Sc. Part- III

Paper III : Linear Programming & Computational Techniques

UNIT – I

General linear programming problems and their formulations. Method for solving LPP : Graphical Method, Simplex method. Duality in LPP.

UNIT – II

Transportation problem: North-west corner rule, Least cost method, Vogel's approximation method. Optimum solution by MODI method. Assignment Problem : Hungarian Algorithm.

UNIT – III

Introduction to computer : What is computer, characteristics, limitations and applications of computer, fundamentals of hardware, software and their types, number system (Binary, octal, decimal, hexadecimal), operating systems and its types.

Computer language and communication : communication, its components and modes, MODEM, digital and Analog signals, introduction to networking, various topologies of network, LAN, WAN, working knowledge of internet, low level language, high level language, 4GL.

UNIT – IV

C Programming : Design of Algorithms and flow charts, character set, constants, variables and data types, declaration of variables, operators and expressions.

Input and output operation, decision making with IF, IF-ELSE, nesting IF, ELSE IF ladder, switch structure, goto structure, loops – FOR, WHILE, DO-WHILE, BREAK, CONTINUE.

Array declaration, initialization, of one dimensional and two dimensional.

B.A. / B.Sc. Part III

PRACTICALS

The practical examination will be based on papers Paper I, Paper II and Paper III and will cover the following experiments:

List of Practical experiments:

1. Non-parametric test – Run test and Test for randomness.
2. Construction of forward difference tables and divided difference tables.
3. Interpolation by Newton's forward difference formula for equal intervals and calculation of error.
4. Interpolation by Newton's divided difference formula for unequal intervals.
5. Interpolation by Lagrange's formula.
6. Approximate Integration (Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules), Weddle's rule.
7. Time Series : Trend by moving average method & Method of least squares. Seasonal indices.
8. Index number : Construction of various index numbers and application of mathematical tests.
9. Vital statistics : Various birth & death rates. Life table.
10. Control charts : $\bar{x}$, R, p and c-charts.
11. Computer applications : Problems involving sequential, decision making and looping structure. Arrays applications – searching, sorting, largest & smallest element of array, addition, multiplication of 2 arrays. Statistical problems – mean, variance, moments, correlations & regression.

REFERENCES :

1. Mood, A.M., Graybill F and Boes D.C. : Introduction to the theory of Statistics.
2. Gibbons, J.D. : Non-parametric statistical inference
3. Conover, W.J. : Practical Non-parametric Statistics
4. Freeman : Finite Differences.
5. Scarborough : Numerical Analysis.
6. S.S. Sastry : Introductory Methods of Numerical Analysis.
7. Saxena, H.C. : Calculus of Finite differences.
8. Croxton F.E. and Cowden D.J. : Applied General Statistics
9. Goon, Gupta and Dasgupta : Fundamentals of Statistics, Vol. I & II
10. Gupta, S.C. and Kapoor, V.K. : Applied Statistics.
11. Swarup Kanti, Gupta P.K. and Man Mohan : Operations Research.
12. Taha, H.A. : Operations Research.
13. Sinha, P.K. : Fundamentals of computer.
14. Yashwank Kanitkar : Let us C.
15. Balaguru Swamy : Ansi C.

UNIFIED SYLLABUS OF STATISTICS
B.A. Part- I

Paper I: Statistical Methods and Theory of Attirbutes:

UNIT-I

Concept of statistical population, Attributes and variables (Discrete and Continuous). Different types of scales – nominal, ordinal, ratio and interval. Primary data – designing a questionnaire and schedule, collection of primary data, checking their consistency. Secondary data, its major sources, scrutiny of data for internal consistency and detection of errors of recording. Presentation of data : classification, tabulation, diagrammatic & graphical representation of grouped data. Frequency distributions, cumulative frequency distributions and their graphical representations, histogram, frequency polygon and ogives. Stem and Leaf plot. Box Plot.

UNIT-II

Measures of central tendency – arithmetic mean, median, mode, harmonic mean, geometric mean – their properties, merits and demerits. Measures of dispersion – range, quartile deviation, mean deviation, standard deviation with their merits and demerits, coefficients of dispersion.

Moments, Sheppard's correction for moments for grouped data (without derivation). Skewness and Kurtosis and their measures including those based on moments and quartiles.

UNIT-III

Bivariate data, principles of least squares, fitting of polynomial curves and fitting of curves reducible to polynomial form.

Corrlation and Regression, Spearman's rank correlation. Partial and Multiple correlation and Multiple regression for trivariate data, their measures and related results.

UNIT-IV

Theory of attributes : Notion and terminology, Contingency table, class frequencies, ultimate class frequencies, consistency. Association of attributes, independence, measure of association for 2x2 table, Yule's coefficient of association. Contingency tables.

UNIFIED SYLLABUS OF STATISTICS
B.A. Part- I

Paper – II : Probability and Probability Distributions.

UNIT – I

Random experiment, trial, sample point and sample space, events, operations of events, concepts of equally likely, mutually exclusive and exhaustive events.

Definition of probability : Classical, relative frequency and axiomatic approaches. Discrete probability space, properties of probability under set theoretic approach. Independence of events, Conditional probability, total and compound probability theorems, Bayes theorem and its applications.

Random variables – discrete and continuous, probability mass function (pmf) and probability density function (pdf), Cumulative distribution function (cdf). Joint distribution of two random variables, marginal and conditional distributions.

UNIT – II

Independence of random variables. Expectation of a random variable (rv) and its properties., expectation of sum of random variables and product of independent random variables, conditional expectation and related problems.

Moments, moment generating function (m.g.f.) & their properties, continuity theorem for m.g.f. (without proof). Cumulants and c.g.f., characteristics function (definition only). Chebyshev's inequality. Weak law of large numbers and Central Limit Theorem for a sequence of independently and identically distributed random variables and their applications (statement only).

UNIT – III

Discrete univariate distributions : Uniform, Binomial, Poisson, Hypergeometric, Geometric and Negative binomial distributions, fitting of binomial and poisson distributions.

UNIT – IV

Continuous univariate distributions : Uniform, Normal, Exponential, Gamma, Beta and Cauchy distributions, fitting of normal distribution.

Exact sampling distributions : chi-square, t and F with distribution function and their simple properties.

B.A. Part- I

PRACTICAL

The practical examination will be based on papers I and II, and will cover the following experiments.

List of Practical Experiments

1. Graphical representation of data by Histogram, Frequency polygons, frequency curves and Ogives.
2. Calculation of measures of location.
3. Calculation of measures of dispersion.
4. Calculation of moments, measures of skewness and measures of Kurtosis.
5. Fitting of curves by method of least squares.
6. Determination of regression lines and calculation of correlation coefficient – grouped and ungrouped data.
7. Calculation of multiple and partial correlation coefficients for three variables
8. Calculation of measures of association in contingency tables.
9. Testing independence of attributes in m x n contingency table.
10. Fitting of Binomial, Poisson and Normal distributions to observed data.

REFERENCES:

1. Goon, Gupta and Dasgupta : Fundamentals of Statistics, Vol I. The Worlds Press Pvt. Ltd., Calcutta.
2. Yule, G.U. and Kendall, M.G.: An Introduction to the theory of statistics. Charles Griffin & Company Ltd.
3. Gupta, S.C. and Kapoor, V.K. : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.
4. Parzen, E.S. : Modern Probability Theory and Its Applications.
5. Meyer, P.: Introductory Probability and Statistical Applications.
6. Mood A.M., Graybill F.A. and Boes D.C. (1974) : Introduction to the theory of Statistics, McGraw Hill.

UNIFIED SYLLABUS OF STATISTICS
B.A. Part- II

Paper I : Statistical Inference and Analysis of Variance.

UNIT – I

Point estimation. Characteristics of a good estimator: Unbiasedness, consistency, sufficiency and efficiency. Method of maximum likelihood and properties of maximum likelihood estimators (without proof). Method of minimum Chi-square. Method of Least squares and method of moments for estimation of parameters. Problems and examples.

UNIT – II

Sufficient Statistics, Cramer-Rao inequality and its use in finding MVU estimators. Statistical Hypothesis (simple and composite). Testing of hypothesis. Type I and Type II errors, significance level, power of a test. Definitions of Most Powerful (MP), Uniformly Most Powerful (UMP) and Uniformly Most Powerful Unbiased (UMPU) tests.

UNIT – III

Neyman-Pearson's lemma and its applications for finding most powerful tests for simple hypothesis against simple alternative. Interval estimation – concept of interval estimation confidence interval for mean & variance in case of normal population only.

Test of significance – large sample test for proportions and means : (i) single sample, (ii) two independent samples. Tests based on chi-square, t and F distributions.

UNIT-IV

Analysis of Variance. One way classification. Assumptions regarding model. Two way classification with one observations per cell.

UNIFIED SYLLABUS OF STATISTICS
B.A. Part- II

Paper II : Survey Sampling and Design of Experiments.

UNIT – I

Sampling Method : Concept of population, sample, parameter and statistic, sampling versus census, advantages of sampling methods, role of sampling theory, sampling and non-sampling errors, bias and its effects, probability sampling.

Simple Random sampling with and without replacement, use of random number tables in selection of simple random sample, estimation of population mean and proportion. Derivation of expression for variance of these estimates. Estimates of variance. Sample size determination.

UNIT-II

Stratified random sampling. Problem of allocation, proportional allocation, optimum allocation. Derivation of the expression for the standard errors of the usual estimators when these allocation are used. Gain in precision due to stratification.

Systematic sampling : estimation of population mean and population total, standard errors of these estimators. Cluster sampling with equal clusters. Estimation of population mean and their mean square error.

UNIT-III

Principles of Design of experiments: Randomization, Replication and local control. Choice of size and type of a plot using uniformity trials. Completely Randomized Design (CRD), Randomized Block Design (RBD). Concept and definition of efficiency of design. Comparison of efficiency between CRD and RBD.

UNIT-IV

Latin Square Design (LSD), Lay-out, ANOVA table, Comparison of efficiencies between LSD and CRD, LSD and RBD.

Factorial Experiments : general description of factorial experiments; 2^2, 2^3 and 2^n factorial. Definition of main effects and interactions in 2^2 and 2^3 factorial. Preparation of ANOVA by Yate's procedure. Estimates and tests for main and interaction effects.

B.A. Part- II
PRACTICAL

The practical examination will be based on papers I and II, and will cover the following experiments:

List of Practical Experiments

1. Chi-square test for (i) $\sigma = \sigma_0^2$, (ii) Goodness of fit, (iii) independence of two attributes.
2. t – test for (i) $\mu = \mu_0$ (ii) $\mu_1 = \mu_2$ (iii) $\rho = 0$
3. F-test for $\sigma_1^2 = \sigma_2^2$
4. Large sample tests.
5. ANOVA in one-way and two-way classification.
6. Analysis of LSD.
7. Drawing a simple random sample with the help of table of random numbers.
8. Estimation of population means and variance in simple random sampling.
9. Stratified random sampling for population mean (proportional and optimum allocation).
10. Factorial Experiment Practical.

REFERENCES

1. Hogg & Craig : Mathematical Statistics.
2. Mood, Graybill and Boes : Introduction to the theory of Statistics.
3. Goon, Gupta and Dasgupta : Fundamentals of Statistics, Vol. I and Vol. II
4. Gupta, S.C. and Kapoor, V.K. : Fundamentals of Statistics.
5. Gupta, S.C. and Kapoor, V.K. : Applied Statistics..
6. Cochran, W.G. : Sampling Techniques
7. Cochran and Cox : Experimental Design.
8. Das & Giri : Design and Analysis of Experiments (Wiley Eastern).