M.Sc. Statistics / M.A. Statistics

PGSTAT-01 / MASTAT-01

Mathematical Analysis

Block 1- Riemann Stieltjes integrals, Fourier series and Functions of bounded variation

Unit 1: Riemann Stieltjes integrals

Absolutely continuous functions. Riemann Stieltjes integrals. Basic theorems. Definitions, Linear properties, integration by parts, change of variable in . Riemann Stieltjes integrals, upper and lower integrals, necessary and sufficient conditions for existence of . Riemann Stieltjes integrals, integral as a function of parameters, differentiation under the integral sign.

Unit 2: Fourier series,

Fourier series, orthogonal system of functions, Fourier series of a function relative to an orthogonal system, properties of Fourier coefficients, Reusz- Fischar theorem, convergence and representation problems for Fourier metric series, sufficient conditions for convergence of Fourier series at a particular point.

Unit 3: Bounded Variation

Functions of bounded variation, total variation, function of bounded variation expressed as the difference of increasing functions, continuous functions of bounded variation, Absolutely continuous functions.

Block 2- Metric spaces & Continuity

Unit 4: Metric spaces

Metric Spaces, open and closed sets, limit and cluster points, Cauchy Sequences and completeness, Convergence of sequences, Completeness of R". Baire's theorem. Cantor's ernary set as example of a perfect set which is now here dense.

Unit 5: Continuity

Continuity and uniform continuity of a function from a Metric space to a Metric space. Open and closed maps, Compact spaces and compact sets with their properties. Continuity and compactness under continuous maps.

PGSTAT-02 / MASTAT-02

Probability and Distribution

Block 1- Probability Measure, Distribution Function and Inequalities

Unit 1: Probability measure and distribution functions

Probability space of a random experiment .probability measures, random variables as a measurable function. Field induced by a sequence of random variables, decomposition of distribution functions in purely discrete, absolutely continuous and singular components.

Unit 2: Probability Inequalities

CR-inequality, Cauchy-Schwartz inequality, Holder inequality, Minkowski inequality, Jensen inequality, Lyapunov inequality, Kolmogorov inequality, Hajck-Renyki inequality.

Block 2- Convergence, Characteristics Function and Limit Theorems

Unit 3: Convergence

Sequences of distribution functions, Helly - Bray theorem, Different types of convergence of sequence of random variables distribution function of random vectors, Weak and strong law of large numbers, Khinchin. Borel and Kolmogorav theorems.

Unit 4: Characteristic function and central limit theorems

Borel-Cantelli lemmas and zero-one law, Characteristic function, Inversion theorem, Continuity theorem, One dimensional central limit problem: lindeberg-levy, Lyapunov, Lindeberg-Feller theorems.

PGSTAT-03 / MASTAT-03

Statistical Inference

Block 1 - Estimation Theory

Unit 1: Sufficiency, Completeness and exponential family

Estimation: Sufficiency, Completeness, Rao-Blackwell theorem, Lehman Schaffer theorem, Cramer-Rao inequality minimal sufficiency, Completeness, Bounded completeness, Ancillary statistics, Basu's theorem on independence of Statistics, Exponential family

Unit 2: Methods of estimation and criterion for good estimators

Bhattacharya bound, Chapman Robbins and Kiefer (CRK) bound, maximum likelihood estimation, Zehna theorem for invariance, Cramer theorem for weak consistence, asymptotic normality, BAN and CAN estimators, asymptotic efficiency.

Block 2: Confidence Estimation and Hypothesis Testing

Unit 3: Confidence estimation

Confidence interval and confidence coefficient, shortest length confidence interval, relation between confidence estimation and hypotheses testing.

Unit 4: Hypothesis Testing

Generalized Neyman Pearson lemma, UMP tests for distributions with MLR, LR tests and their properties, UMPU tests, similar regions, Neyman structure, Invariant tests.

PGSTAT-04 / MASTAT-04

Linear Models and Design of Experiments

Block 1 - Linear Estimation and Analysis of Variance

Unit 1: Linear model and BLUE

Linear Estimation- estimable functions, estimations and error space, Best linear unbiased estimate (BLUE), Markov theorem distribution of quadratic form, Estimable linear hypotheses generalized F and T tests.

Unit 2: Analysis of Variance

Analysis of Variance : Two-way classification with equal number of observation per cell and Tukey's test general two-way classification, Analyses of covariance,

Block 2 - Design of Experiment

Unit 3: Factorial Experiments

2^n , 3^2 and 3^3 factorial experiments complete and partial confounding.

Unit 4: BIBD and Split plot design

Balanced Incomplete Block Design (BIBD), construction of BIBD, intra block and inter block analysis, split plot design.

PGSTAT-05 / MASTAT-05

Survey Sampling

Block 1 - Random Sampling Procedures

Unit 1: Stratified Sampling and use of auxiliary information

Sampling Theory: stratified sampling, Post-stratification and deep stratification, Methods of allocation, ratio and regression estimators, double sampling in ratio and regression estimation.

Unit 2: Cluster and multi-stage sampling

Cluster sampling with equal clusters two stage and multi-stage sampling, Non sampling errors.

Block 2 - Varying Probability Sampling

Unit 3: Methods of selection and ordered estimators

Varying probability sampling with and without replacement, cumulative total and Lahiri's methods of selection, Estimation of population mean, Desraj ordered estimates.

Unit 4: Unordered estimators

Horvitz-Thompson estimator, Midzuno and Narain system of sampling.

PGSTAT-07(P) / MASTAT-07(P)

Practical based on PGSTAT- 03, 04, 05 / MASTAT- 03, 04, 05

PGSTAT-08 / MASTAT-08

Stochastic Process

Block I: Markov Chains

Unit I: Markov dependent trials and transition probabilities

Two state Markov sequences, Markov chains, determination of n-step transition probabilities, Chapman-Kolmogorov equations, first return and first passage probabilities.

Unit II: Classification of states

Classification of states, communication states, periodicity, stationary probability distributions and limit theorems for Ergodic chains.

Block 2: Continuous time Markov processes and branching processes

Unit III: Continuous time Markov processes

Continuous time Markov processes. Poisson (point) process, birth and death processes, random walk and gambler's ruin problem.

Unit IV: Branching processes

Simple branching process, probability generating function and moments of number of individuals in the n-th generation, fundamental theorem of probability of extinction.

PGSTAT-09 / MASTAT-09

Decision Theory

Block 1: Basic elements and Bayes rules

Unit 1: Basic elements

Decision theoretic problem as a game, basic elements, optimal decision rules, unbiased ness, invariance, ordering.

Unit 2: Bayes and Minimax rules

Bayes and minimax principles, generalized. Bayes rules, extended Bayes rules,

Block 2: Optimality of decision rules

Unit 3: Admissibility and Completeness

Admissibility, completeness, minimal complete class, separating and supporting hyper plane theorems,

Unit 4: Minimaxity and multiple decision problems

Minimax theorem, complete class theorem, equalizer rules, examples, multiple decision problems.

PGSTAT-10 / MASTAT-10

Multivariate Analysis

Block 1: Multivariate normal distribution and estimation of parameters

Unit 1: Multivariate normal distribution

Multivariate normal distribution, Characteristic function, marginal and conditional distributions, multiple and partial correlation coefficient.

Unit 2: MLE of parameters and sampling distributions of multiple and partial correlations

Maximum likelihood estimators of the mean vector and covariance matrix, sample Multiple and partial correlation coefficients and their null sampling distributions

Block 2: Distributions related to MND and their applications

Unit 3: Wishart distribution and Hoteling's T^2

Wishart distribution. Its characteristic function, additive property of Wishart distribution, Hoteling's T^2 and its applications

Unit 4: Mahalnobis D^2 and Discriminant analysis

Mahalanobis D^2 and its various applications, Discriminant analysis.

PGSTAT-11 / MASTAT-11

Nonparametrics

Block 1- Order Statistics

Unit 1: Basic Distribution Theory

Order statistics, Distribution of maximum, minimum and r-th order statistic, Joint distribution of r-th and s-th order statistic,

Unit 2: Distribution Free Intervals

Distribution of range function of order statistics, distribution free confidence intervals for quintiles, distribution free tolerance interval, Fooleries limits.

Block 2- Non- Parametric Tests

Unit 3: One- sample and Two Sample Location Tests

Sign test. Wilcoxon test, Median test,

Unit 4: Other non- parametric tests

one sample and two sample location tests. Mann- Whitney U- Test, Application of U-statistic to rank tests. One sample and two sample Kolmagorov-Smirnov tests. Run tests. Pitman ARE.

PGSTAT-12 / MASTAT-12

Econometrics

Block 1: Linear Model and its generalizations

Unit 1: Linear regression models, estimation of parameters and prediction

Linear regression model. Assumptions, estimation of parameters by least squares and maximum likelihood methods tests of hypotheses and confidence estimation for regression coefficients, R^2 and adjusted R^2, point and interval predictors

Unit 2: Model with qualitative independent variables and non-spherical disturbances

Use of dummy variables, model with non-spherical disturbances, estimation of parametric by generalized equation, Seemingly unrelated regression equations (SURE) model and its estimation

Block 2: Simultaneous equations model

Unit 3: Structural and reduced form of the model and identification problem

Simultaneous equations model, concept of structural and reduced forms, problem of identification, rank and order conditions of indentifiability

Unit 4: Estimation in simultaneous equation models

Limited and full information estimators, indirect least squares estimators, two stage least squares estimators, three stage least squares estimators.

PGSTAT-14(P) / MASTAT-14(P)

Practical based on PGSTAT / MASTAT-10 , 11, 12 & 13

PGSTAT-13 / MASTAT-13

Demography

Block -1. Migration

Unit-I : Introduction, Estimation of life time and inter-censal migration from place of birth statistics, estimation of internal migration from statistics on duration of residence, at a fixed proor date.

Unit -2 : Indirect measure of net internal migration based on growth rate method, methods to estimate intercensal migration-using vital statistics, life time survival ratio method and census survival methods, estimation of international migration.

Block-2. Stable Population Theory

Unit-1 :Introduction, basic concepts of stable, quasi-stable, stationary and non-stable populations, vital rates and characteristics of stationary stable population and quasi-stable population.

Unit-2 : Definition of intrinsic rates of natural increase, intrinsic birth rate and intrinsic death rate, their relationship, derivation of Lotka's formulae of fundamental relationship instable population.

Unit-3 : Computation of intrinsic rate of natural increase and construction of stable age distribution from the given fertility and mortality schedules, relationship between net reproduction rate(NRR), intrinsic rate of natural increase and mean length of generation, concept of mean interval between two generations.

Block-3.Fertility & Fertility Models.

Unit-1 : Introduction, crude birth rate (CBR), gross fertility rate (GFR,) age specific fertility rate) ASFR), total fertility rate (TFR), gross reproduction rate (GRR)

Unit-2 : Period and cohort measures, use of birth order statistics, child women ratio, own-children method, children ever born(CEB) data and with data on current fertility, Brass P/F ration for adjusting fertility rates.

Unit-3 : Simple model on time of first birth/conception and number of births/conception n specified time, birth interval models, study of fertility through birth interval analysis.

Block-4. Mortality

Unit-1 : Introduction, crude death rate (CDR), specific death rates (SDR), standardized death rate (STDR).

Unit-2 : Life table, abridge life table, model life table of UNO (old and new), coale and demny model, brass model through logit transformation.

B.Sc. Statistics / B.A. Statistics

UGSTAT-01

Statistical Methods

BLOCK – I . Data Collection and Its Representation

Unit-I- Data Collection and Tabulation :

Meanings, Definitions and Applications of Statistics, Measurements and Scale, Measurements of qualitative data, Methods of data collection, Types of data.

Unit-II- Representation of Data- I (Diagrammatical representation):

Frequency distribution, Tabulation of data, Diagrammatical Representation of data, Bar diagram, Multiple bar diagram, Divided bar diagram, Percentage bar diagram, Pie chart, Pictogram, leaf chart,

Unit-II- Representation of Data- I (Graphical representation):

Graphical representation of frequency distribution, Histogram, Frequency polygon, Frequency curve, Ogive.

BLOCK – II . Measures of Central Tendency and Dispersion

Unit-I- Measures of Central Tendency :

Types of measures of central tendency, Arithmetic mean, Fundamental Theorems on Arithmetic mean, Geometric mean, Harmonic mean, Median, Mode, Percentiles, Deciles, and Quartiles.

Unit-II- Measures of Dispersion :

Types of measures of Dispersion, Range, Mean Deviation, Variance and Standard deviation, Effect of change of origin and scale, Relationship between measures of central tendency and measures of dispersion, Coefficient of variation.

BLOCK – II . Moments, Skewness and Kurtosis

Unit-I- Moments, Raw Moments and Central Moments :

Definition of moments, raw moments for ungrouped data, raw moments for grouped data, Central moments, Factorial moments, Interrelationship between various moments, effect of change of origin and scale on moments, Charlier's checks, Sheppard"s correction for moments.

Unit-II- Skewness and Kurtosis :

Definition of skewness, Measures of skewness, Pearson's coefficient, Bowley's coefficients, Kurtosis, Measures of Kurtosis, effect of change of origin and scale.

UGSTAT-02

Probability And Probability Distribution

BLOCK – I . Probability Theory

Unit-I- Random experiments and Probability :

Deterministic and random experiments, Sample space, Events, Algebra of Events, Axiomatic definition of Probability, Classical definition of Probability, Statistical definition of probability, Addition Theorem of Probability .

Unit-II- Conditional Probability:

Conditional probability, Multiplicative theorem of Probability, Independent events, Partition of sample space, Baye's Theorem.

BLOCK – II . Probability Distributions and Expectations

Unit-I- Random Variables and Probability Distributions:

Definition and types of random variable, Cumulative distribution function and its properties, Probability Mass Function, Probability Density Function..

Unit-II- Expectation:

Definition and types of Mathematical Expectation, Moments in terms of expectation, Mathematical and Multiplication theorems of Expectation, other theorems on expectation.

Unit-III- Inequalities for Moments:

Cauchy-Schwartz Inequality, Markov's inequality, Chebyshev's inequality.

BLOCK – III . Concept of Probability Distributions

Unit-I- Univariate Distributions:

Bernoulli Distribution, Binomial Distribution, mean and variance of binomial distribution, Moments, Moments Generating Function, Additive and Multiplicative property, Recurrence relation for moments, Fitting of Binomial Distribution, Poisson Distribution, Poisson Distribution as a limiting case of Binomial Distribution, mean and variance of Poisson distribution, Moments, Moment Generating Function, Additive and Reproductive property, Recurrence relation for moments, fitting of Poisson Distribution.

Unit-II- Discreet Distribution:

Geometric Distribution, mean and variance, moment generating function of geometric distribution, Negative Binomial Distribution, Moment Generating Function, Mean and Variance, Recurrence formulae for negative Binomial Distribution, Poisson Distribution as a limiting case of Negative Binomial Distribution, Hyper Geometric Distribution, Mean and Variance, Recurrence relation for Hyper Geometric distribution..

Unit-III- Normal Distribution:

Normal Distribution and its parameters, Standard Normal Distribution, Moments, Moments Generating Function, Area Property, properties of normal curve, Standard Scores, Advantages and Characteristics of Z Scores.

Unit-IV- Continuous Distribution:

Uniform Distribution, Moment Generating Function, Distribution Function, Moments of Uniform Distribution, Exponential Distribution, Moments, Moment Generating Function, Lack of Memory Property.

UGSTAT-03

Correlation, Regression And statistical Inference

BLOCK – I . Correlation and Regression

Unit-I- **Bivariate Data and Correlation:**

Scatter Diagram, Karl Pearson's coefficient of correlation, Properties of correlation coefficient, limits of correlation coefficient, Effect of change of origin and scale on correlation coefficient.

Unit-II- **Regression:**

Regressions, linear regression model, principal of least square, Regression lines, Regression coefficient, Properties of Regression coefficients.

Unit-III- **Correlation and Intra Class Correlation:**

Rank correlation coefficient, Spearman's rank correlation coefficients, rank correlation coefficient for tied ranks, Intra-class correlation, some remarks on Intra-class correlation.

Unit-IV- **Theory of Attributes:**

Combinations, Classes and Class frequencies of Attributes, Dichotomous Classification, Consistency of data, joint distribution of attributes, Contingency tables, Independence and Association of Attributes, Measures of Association, Yates Correction.

BLOCK – II . Basic Principles of Statistical Inference

Unit-I- **Estimation :**

Point Estimation, properties of a good estimators, Consistency, Unbiased ness, Efficiency, Sufficiency, Confidence Interval Estimation .

Unit-II- **Method of Estimation:**

Procedures of Estimation, Method of Moments, method of Maximum Likelihood, Method of Scoring, Properties of Estimators.

Unit-III- **Testing of Hypothesis :**

Statistical Hypothesis, Simple and Composite Hypothesis, Critical Region, Two kinds of Error, One-tailed and Two-tailed tests, Test of Significance, Most Powerful Test, Uniformly Most Powerful Test .

BLOCK – III . Test of Significance

Unit-I- **Exact Tests and Fisher's transformations :**

Tests of Significance based on Chi-Square Distribution, Tests of Significance based on t – Distribution, Tests of Significance based on F – Distribution, Tests of Significance based on Fisher's Z - Distribution.

Unit-II- **Large Sample Tests :**

Testing Significance of Mean, Testing Equality of Means, Testing Significance of Proportion, Testing Equality of Proportions, Testing Significance of Standard Deviation, Testing Equality of Standard Deviation.

Unit-III- **Non-Parametric Tests :**

Non Parametric Tests, Sign Test, Wilcoxon Signed- Rank Test, Mann- Whitney U-Test, Run Test.

UGSTAT-04

Sampling Theory and Design of Experiments

BLOCK – I . Samplings Theory - I

Unit-I- **Simple Random Sampling:**

Advantages of Sampling over Complete Enumeration, Sampling and Non Sampling Errors, Probability or Random Sampling, Bias of an Estimator, Measures of Sampling Error, Simple Random Sampling Without Replacement (SRSWOR) .

Unit-II- **Stratified Random Sampling:**

Introduction, Reasons & Advantages of Stratification, Some theorems .

Unit-III- **Allocation of Sample Size and Systematic Sampling:**

.Introduction, Equal Allocation, Proportional Allocation, Variance of Stratified Mean under Proportional Allocation, Optimum Allocation, Varience of Stratified Mean under Neyman Allocation, Relationship Among Three Variences, Impact of Arbitrary Allocation, Practical difficulties in Implementing Neyman Alloation, Systematic Random Sampling.

BLOCK – II . Sampling Theory - II

Unit-I- **Ratio and Regression Methods of Estimation:**

Introduction, Ratio and Regression Estimators, Approximate Variances of the Ratio Estimators

Unit-II- **Cluster and Two Stage Sampling:**

Cluster Sampling (Equal Cluster- Size), Estimation of Mean with SRS at both Stages, Relative Efficiency of Cluster Sampling, Two Stage Sampling, Estimation of Mean, Optimum Allocation when Cost Fixed and when Variance Fixed, Two- Phase (Double) Sampling for Stratification, Estimation of Mean, Difference between Multistage Sampling and Two Phase Sampling.

Unit-III- **Non- Sampling Errors: Response Error and Non Response Errors:**

Introduction, Errors in Sampling, Sampling Errors, Non Sampling Errors, Response Errors, Sources of Non Sampling Errors, Method of Minimizing Non- Response Errors.

BLOCK – III . Design and Analysis of Experiments

Unit-I- **Analysis of Variance, Design of Experiment and Completely Block Design :**

Analysis of Variance, Linear Models and Analysis of Variance, Design of Experiment, Basic Principles of Design of Experiments, Completely Randomized Design.

Unit-II- **Randomized Block Design and Latin square Design:**

Randomised Block Design, Efficiency of RBD, Missing Plot Technique, Latin Square Design, Efficiency of LSD.

UGSTAT-05

Numerical Methods & Basic Computer Knowledge

BLOCK – I . Finite Differences

Unit-I- **Finite Differences:**
Forward Difference Operator, Difference Table, The Operator E, The Operator D, Backward Differences, Factorial Polynomial, Central Differences, Mean Operator.

Unit-II- **Interpolation With Equal Intervals:**
Introduction, Missing Values, Newton- Gregory Forward & Backward Interpolation Formula,

Unit-III- **Interpolation With Un-Equal Intervals:**
.Introduction, Missing Values, Properties of Divided Differences, Newton's Divided Difference Interpolating Polynomial, Error of the interpolation Polynomial Divided Differences and Derivatives.

Unit-IV- **Lagrange's Interpolation :**
Introduction, Lagrange's Interpolating Polynomial, General Error term or Reminder Term, Linear Interpolation, error in Linear Interpolation.

BLOCK – II . Central Differences

Unit-I- **Central Difference Interpolation Formulae:**
Introduction, Gauss Forward & Backward Formulae, Stirling's Formula, Bessel's Formula, Bessel's Formula for halves.

Unit-II- **Inverse Interpolation:**
Inverse Interpolation by Lagrange's method, method of Successive Approximation, Method of Reversion of Series.

Unit-III- **Numerical Differentiation:**
Introduction, Numerical Differential for Equal Intervals, Numerical Differential for Un-Equal Intervals, Approximation Formulae for the Derivative of a Function.

Unit-IV- **Numerical Integration:**
Introduction, Trapezoidal Rule, Simpson's One-Third Rule, Simpson's Three-Eighth Rule, Waddle's Rule, Eular-Macularian Formula.

BLOCK – III . Computer

Unit-I- **Introduction to Computer :**
Introduction, Characteristics of computer, Historical Evaluation of Computer, Generation of Computers, Classification of computers.

Unit-II- **Hardware:**
Introduction, CPU, Memory Organization, Input-Output Devices.

Unit-III- **System Software:**
Introduction, System Software, File Commands, Editing, Commands, Disk Management Commands, Number System

BLOCK – IV . Basics of Computer Programming

Unit-I- **Algorithm & Flow Charts :**
Introduction, Algorithm, Flow Charts.

Unit-II- **Programming Language:**
Introduction, Machine Language, Assembly Language & Assembler, High Level Language, Object Oriented Programming, Programming Language Generation..

UGSTAT-06

Applied Statistics

BLOCK – I . ***Index Numbers:***

Unit-I- **Index Number: General Theory:**

Definition & Construction of an Index number, Price Relatives, Quantity or Volume Relatives, Value Relatives, Link & Chain Relatives, Problem involved in computation of an Index Number .

Unit-II- **Index Numbers: Important Formulae:**

Introduction, Calculation of Index Number, Laspeyre's, Paasche's, Marshall-Edgeworth's, fisher's formulae, other indices, Quantity Index, Criteria of good Index Number

Unit-III- **Consumer Price Index Number:**

Introduction, Construction & Computation of Consumer Price Index Number (CPI), Steps in construction of CPI, Use & Limitations of CPI, Base Shifting of Index Numbers, Splicing of Index Number Series, Deflating the Index Number, Index of Industrial Production.

BLOCK – II . ***Time Series Analysis:***

Unit-I- **Time Series:**

Introduction, Utility of Time Series Analysis, Component of Time Series, Mathematical Models For Time Series Analysis.

Unit-II- **Determination of Trends:**

Introduction, Graphic Method, Method of Semi Averages, Method of Curve Fitting by the Principle of Least Squares, Method of Moving Averages (when Period is Even & Odd).

Unit-III- **Determination of Seasonal Indices:**

Introduction, Measurement of Seasonal Indices, Method of Simple Averages, Ratio to Trend Method, Ratio to Moving Average Method, Method of Link Relatives.

BLOCK – III . ***Demography:***

Unit-I- **Sources of Demographic Data :**

Introduction, Demography & Vital Statistics, Sources of Demographic Data, Errors in Data Collection, Evaluation & its Adjustments, Rates & Ratios.

Unit-II- **Measures of Mortality:**

Introduction, Measures of Mortality, CDR, SDR, StDR, MMR, IMR.

Unit-III- **Measures of Fertility :**

Introduction, Measures of Fertility, CBR, GFR, ASFR, TFR.

Unit-IV- **Life Tables:**

Introduction, Description & Construction of Complete Life Table, Uses of a Life Table.

Unit-IV- **Measures of Reproductivity:**

Introduction, GRR, NRR.

BLOCK – III . ***Statistical Quality Control:***

Unit-I- **Introduction of Statistical Quality Control :**

Introduction, Advantages of Quality Control, Quality Characteristics, Basic Principles & Operating Characteristics of Control Charts, Choice of Control Limits, Sample Size & Sample Frequency, Rational Subgroups, Analysis of Pattern on Control Charts, Rate of Detection of Change in Average Level.

Unit-II- **Control Charts for Variables:**

Introduction, Control Charts for Mean, Control Charts FDor Range, Control Charts for Standard Deviation.

Unit-III- **Control Charts for Attributes :**

Introduction, Control Charts for Fraction Defectives, Control Charts for Number of Defectives, Control Charts for Number of Defects .

Unit-IV- **Principles of Acceptance Sampling:**

Introduction, AQL, LTPD, Producer's Risk, Consumer's Risk, OC Function, AOQ, Average Total Inspection, Average Sample Number, Single Sampling Plan, Double Sampling Plan, Sampling Inspection by Variables.

UGSTAT-07

Operation Research

BLOCK – I . Formulation of Linear Programming Problems

Unit-I- **Introduction to Operation Research:**

Introduction, Phases of OR Problem, Operation Research Modeling Approach, Defining the Problem & Gathering Data, Formulating a Mathematical Models, Deriving Solution from the Model Introduction to Linear Programming, Formulation of a Linear Programming Problem with examples.

Unit-II- **Graphical Method top Solve LPP:**

Introduction, Graphical Solution to Linear Programming Problem.

BLOCK – II . Simplex Method of Solving LPP

Unit-I- **Simplex Method :**

Introduction, Principle of Simplex Method, Simplex Method with Several Decision Variables, Two Phase & M-Method, Multiple, Unbounded Solution & Infeasible Problems, Sensitivity Analysis.

Unit-II- **Duality Problem in LPP:**

Introduction, Dual Linear Programming Problem, Formulation of a Dual Problem with example.

BLOCK – III . Transportation Problem & Assignment Problem

Unit-I- **Representation of Transportation Problem (Non-Generated & Balanced Cases only) & Assignment Problem as Linear Programming Problem:**

Introduction of T.P. & A.P., Transportation Problem as LPP, Non-Degenerate Transportation Problem, Balanced Transportation Problem, Assignment Problem &LPP, Balanced Assignment Problem.

Unit-II- **Different Methods of Finding Initial Feasible Solution of a Transportation Problem (T.P., MODI Method of Finding Optimal Solution of a T.P.) :**

Introduction, Basic Feasible Solution of a Transportation Problem, Modified Distribution Method (MODI), Vogel's Approximation Method (VAM), Maximization in a Transportation Problem .

Unit-III- **Solution of Assignment Problem With using Hungarian Method :**

Introduction, Solution of an Assignment Problem, Hungarian Method, Maximization in an Assignment Problem.

BLOCK – IV . Theory of Games

Unit-I- **Basic Concepts of Game Theory :**

Introduction, A Game, Pure & Mixed Strategies, Two- Person Zero- Sum Game, Pay-Off Matrix, Games without Saddle Point and Mixed Strategies, Methods of Solving Game Problems.

Unit-II- **Dominance Rule, Equivalence of Rectangular Games with Linear Programming :**

Introduction, Rectangular Games without Saddle Point, Dominance Property of reducing the Size of the Game, Solution Methods of Games without Saddle Point, Equivalence of Rectangular Games with Linear Programming.

UGSTAT-08

Advance Statistical Inference

BLOCK – I . Point Estimation

Unit-I- **Introduction to Statistical Inference:**

Introduction, Parameter & Statistic, Parametric & Non-Parametric Methods, Likelihood Function of Sample Values, Sampling Distribution, Standard Error of the Statistic.

Unit-II- **Point Estimation & Cramer Rao Inequality:**

Introduction, Point Estimation, Properties of Estimators, Unbiasedness, Consistency, Efficiency, MVUE, C-R Inequality.

Unit-III- **Sufficiency & Factorization Theorem:**

Introduction, Sufficiency, Neymam- Fisher Factorization Theorem, Koopmam's form of the Distribution, Invariance Property of Sufficient Statistics.

Unit-IV- **Complete Sufficient Statistics & Rao Blackwell Theorem:**

Introduction, Complete Family of Distributions, Rao-Blackwell Theorem.

BLOCK – II . MVU Estimation

Unit-I- **MUV Estimators :**

Introduction, Minimum Variance Unbiased Estimation, Some Theorems on MVUE.

Unit-II- **Complete Sufficient Statistics:**

Introduction, Sufficient Statistic & Completeness, Lehmann- Scheffe Theorem, Construction of UMVUE.

BLOCK – III . Testing of Hypothesis - I

Unit-I- **Preliminary Concepts in Testing:**

Introduction, Types of Hypothesis, Types of Error, Critical Region, Power Function.

Unit-II- **MP & UMP Tests :**

Introduction, Most Powerful Test, Uniformly Most Powerful Test.

BLOCK – IV . Testing of Hypothesis -II

Unit-I- **Neyman- Pearson Lemma, Likelihood Ratio Test & Their Uses :**

Introduction, Neyman-Pearson Lemma, Likelihood Ratio Test.

Unit-II- **Testing of Means of Normal Population :**

Introduction, One Sample Problem, Two Sample Problem.

Unit-I- **Interval estimation :**

Introduction, Confidence Interval & Confidence Coefficient, C.I. For Sample Mean from a Normal Population, C.I. for differences of Means From Two Normal Population.

Unit-II- **Shortest & Shortest Unbiased Confidence Intervals :**

Introduction, Intervals of Shortest Length, Neyman's Principle of Shortest Confidence Interval, Unbiased Confidence Interval, Shortest Unbiased Confidence Interval, Case of Discreet Random Variables.

UGSTAT-09 (P)

Related Practical Based on 01, 02 & 03

UGSTAT-10 (P)

Related Practical Based on 04 & 06

UGSTAT-11 (P)

Related Practical Based on 07 & 08