

Statistics Syllabus for Three Years Degree Course in Semester System To Be Implemented From the Academic Session of 2012 Under Nagaland University Under the new initiatives of the UGC in XI Plan for academic reforms

PROPOSED STRUCTURE OF THE COURSE B.SC. (PASS) COURSE IN STATISTICS (STP)

SEMESTER – I: Theory (STPT-101) DESCRIPTIVE STATISTICS Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical (STPP-102): Marks – 50 (End Semester: 30 + Internal Assessment: 20)

SEMESTER –II: Theory (STPT-201) PROBABILITY AND DISTRIBUTION Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical (STPP-202) Marks – 50 (End Semester: 30 + Internal Assessment: 20)

SEMESTER – III: Theory (STPT-301) ESTIMATION AND TESTING OF HYPOTHESES Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical (STPP-302) Marks – 50 (End Semester: 30 + Internal Assessment: 20)

SEMESTER – IV: Theory (STPT-401) DESIGN OF EXPERIMENTS & SAMPLE SURVEY-I Marks= 100

(End Semester = 70 + Internal Assessment= 30)

Practical (STPP-402) Marks – 50 (End Semester: 30 + Internal Assessment: 20)

SEMESTER- V: Theory (STPT-501) APPLIED STATISTICS - I Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical: (STPP-502) Marks – 50 (End Semester: 30 + Internal Assessment: 20)

SEMESTER-VI: Theory (STPT-601) APPLIED STATISTICS – II Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical :(STPP-602) Marks – 50 (End Semester: 30 + Internal Assessment: 20)

PROPOSED STRUCTURE OF THE COURSE: B.SC. (HONOURS) COURSE IN STATISTICS (STH)

SEMESTER-I: Theory (STHT - 101) MATHEMATICAL STATISTICS Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical: (STHP - 102): Marks – 50 (Practical Exam: 30 + Internal Assessment: 20)

SEMESTER –II: Theory (STHT -201) NUMERICAL ANALYSIS, LPP AND DISTRIBUTION Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical: (STHP - 202): Marks – 50 (End Semester: 30 + Internal Assessment: 20)

SEMESTER–III: Theory (STHT -301) STATISTICAL INFERENCE Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical: (STHP - 302): Marks – 50 (End Semester: 30 + Internal Assessment: 20)

SEMESTER- IV: Theory (STHT - 401) COMPUTER PROGRAMMING & MULTIVARIATE ANALYSIS
Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical: (STHP - 402) : Marks – 50 (End Semester: 30 + Internal Assessment : 20)

SEMESTER – V :Theory (STHT -501) SAMPLE SURVEY AND DESIGN OF EXPERIMENT-II]

Marks = 100

(End Semester = 70 + Internal Assessment = 30)

Practical: (STHP - 502) : Marks – 50 (End Semester: 30 + Internal Assessment : 20)

SEMESTER –VI : Theory (STHT - 601) CHOICE BASED PAPER Marks = 100

(End Semester = 70 + Internal Assessment = 30)

PROJECT : (STHP - 602): Project Marks : 50

Pass Course :

SEMESTER – I Theory(STPT – 101)

Descriptive Statistics :

UNIT- I : GENERAL STATISTICS

Definitions , Scope and Importance of Statistics ; Limitation of Statistics; Collection of Data : Types of data- sources of collection of Primary and Secondary data ; Presentation of data : Definition and types of Classification; definition and different types of tabulation; Measurement of Scales – Nominal, Ordinal, Ratio and Interval scale(with examples) ; Frequency distribution table ; Diagrammatic and Graphical Representation of data. 14 (12L)

UNIT- II : CENTRAL TENDENCY

Measures of Central Tendency : Arithmetic Mean, Geometric Mean , Harmonic Mean, Median and Mode, their merits , demerits and properties; Quantiles- Quartiles , Deciles and Percentiles. 14 (12L)

UNIT- III : DISPERSION

Measures of Dispersion : Different types and their properties , Relative measures of dispersion : Coefficient of variation; Moments : Raw moment and Central moments - Derivation of Central moments in terms of raw moments and vice versa; Skewness and Kurtosis : Different types of measures of skewness and kurtosis , bowley's coefficient of skewness. 14 (12L)

UNIT –IV : FINITE DIFFERENCE

Δ & E operators, Fundamental theorems; Interpolation formulae: Newton's forward, backward with remainder terms; Divided differences: Properties, Newton's Divided difference formula, Lagrange's formulae. 14 (12L)

UNIT – V : NUMERICAL INTEGRATION

General quadrature formula; Trapezoidal Rule, Simpson's 1/3 rd rule; Gauss forward and backward interpolation formula. 14 (12L)

SEMESTER-I : Practicals (STPP – 102)

1. Preparation of blank table
2. Diagrammatic and graphical representation of data
3. Calculation of Measures of Central Tendency, Dispersion, Coefficient of Variation, Skewness and Kurtosis.
4. Calculation of first four central moments and coefficient of skewness and kurtosis
5. Construction of difference tables
6. Use of Newton's forward and backward interpolation formula
7. Lagrange's method of interpolation
8. Use of Newton's divided difference formula
9. General Quadrature formula
10. Simpson's 1/3 rd rule
11. Use of Gauss' forward and backward formula.

Text Books :

1. Medhi. J. (1982): Statistical Methods, New Age International (P) Ltd.
2. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. I, World Press, Calcutta.
3. Gupta S.C. and Kapoor V.K. (2001): Fundamentals of Mathematical Statistics, Sultan Chand and Sons
4. Gupta S.C. (2008): Statistical Methods, Hindustan Publishing House.
5. Saxena H.C. (1981) : Examples in Statistics, Atma Ram & Sons
6. Agarwala, A.K. & Chakraborty, S. (2009) : Statistics : A tutorial text with practicals, Kalyani Publisher

SEMESTER – II:Theory (STPT – 201)

UNIT – I : PROBABILITY

Random experiments, Events, Sample space, definition of probability: classical (mathematical), Statistical (empirical) and Axiomatic (set theoretic) problems; Addition theorem, Conditional Probability, Independence of events, Multiplication theorem, Baye's theorem. Simple illustrative applications. 14 (12L)

UNIT – II : MATHEMATICAL EXPECTATION

Random variables, Discrete and Continuous Random Variables, Probability Mass function, Probability Density function, Cumulative Distribution function; Bi-variate distributions : Discrete and Continuous type, Joint Density Function, Marginal and conditional distribution;

Mathematical Expectation of random variables and functions of random variables and properties. Variance and covariance. 14 (12L)

UNIT – III : GENERATING FUNCTION

Moment Generating Function, Cumulant Generating Function, Probability Generating Function: Definitions, properties and simple illustrative applications; Chebyshev's inequality, Convergence in probability, Weak Law of Large Numbers (WLLN) 14 (12L)

UNIT – IV : CORRELATION AND REGRESSION

Scattered diagram; Correlation : Karl Pearson's coefficient of correlation and their properties and interpretation; Rank correlation; Method of Least Square Estimation ; Fitting of linear Regression; Regression coefficients : their properties and interpretation; Regression Lines. 14 (12L)

UNIT – V : MULTIPLE AND PARTIAL CORRELATION

Three variable regression; Multiple and Partial Correlation (3-variables only); Non-linear regression. 14 (12L)

SEMESTER-II : Practicals (STPP – 202)

1. Examples on Probability
2. Examples on Mathematical Expectation and marginal and conditional distribution.
3. Fitting of straight line and second degree polynomial by the method of least squares.
4. Calculation of Karl Pearson's correlation coefficient
5. Calculation of Rank correlation coefficient
6. Fitting of regression lines
7. Calculation of multiple correlation coefficient and partial correlation coefficient

Text Books :

1. Gupta S.C. and Kapoor V.K. (2001), Fundamentals of Mathematical Statistics, S Chand and Sons
2. Goon A.M, Gupta M.K., Das Gupta B. (1980): An Outline of Statistical Theory, Vol. I, 6th revised edition, World Press, Calcutta.

References :

3. Rohatgi V.K. and Md. Ehsanes Saleh A.K.(2001): An Introduction to Probability and Statistics, Second Edition, Wiley
4. Sheldon M. Ross (2004) : Introduction to Probability Models, Elsevier

5. Mukherjee P. (1995) : Theory of Probability, New Central Book Agency
6. Saxena H.C. (1981) : Examples in Statistics, Atma Ram & Sons
7. Agarwala, A.K. & Chakraborty, S. (2009) : Statistics : A tutorial text with practicals, Kalyani Publisher
8. Hogg R. V. and Craig A. T. (1998); Introduction to Mathematical Statistics, 4/e, Academic press.
9. Mood A.M., Graybill F.A and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.

SEMESTER – III Theory(STPT – 301)

UNIT I: ESTIMATION THEORY

Concept of Parameter, Statistic, Estimator, Estimate; Point estimation: Properties of good estimator – Consistency, Unbiasedness, efficiency and sufficiency with examples; Minimum Variance Unbiased Estimator (MVUE). 14 (12L)

UNIT II: TESTING OF HYPOTHESIS

Statistical Hypothesis: Simple and composite hypothesis, Null and Alternative Hypothesis; Two types of errors; Critical region; p-value; power of a test; Test of significance: Exact and large sample tests for one and two sample mean and proportions based on Normal distribution, t test for one and two sample mean, Chi-square and F-tests. 14 (12L)

UNIT - III : DISCRETE DISTRIBUTION

Bernoulli, Binomial, Poisson - mean, Variance, PGF, MGF, Recurrence relation; Hypergeometric Distribution (Mean, Variance, Uses); Limiting distribution: binomial to Poisson. 14 (12L)

UNIT – IV: CONTINUOUS DISTRIBUTION

Uniform - Moments, MGF, characteristic function; Normal: definition, derivation, properties, Moments, MGF and examples. 14 (12L)

UNIT-V : SAMPLING DISTRIBUTION

Chi-square, t, F and Z : definition , derivation , estimation of moments, properties and their applications. 14 (12L)

SEMESTER-III: Practicals (STPP – 302)

1. Problems on Estimation theory
2. Problems on Testing of Hypothesis.
3. Fitting of binomial and Poisson distribution.

4. Fitting of Normal distribution
5. Problems on Chi-square , t, F, and Z-tests.

Text Books :

1. Gupta S.C. and Kapoor V.K. (2001), Fundamentals of Mathematical Statistics, Sultan Chand and Sons
2. Goon A.M, Gupta M.K., Das Gupta B. (1980): An Outline of Statistical Theory, Vol. 2, 6th revised edition, World Press, Calcutta.
3. Mood A.M., Graybill F.A and Boes D.C. (1974): Introduction to the Theory of Statistics, McGraw Hill.
4. Hogg R.V. and Craig A.T. (1998): Introduction to Mathematical Statistics, Collier Macmillan Press.
5. Rohatgi V.K. and Md. Ehsanes Saleh A.K.(2001): An Introduction to Probability and Statistics, Second Edition, John Wiley Publication.

SEMESTER – IV : Theory(STPT – 401)

DESIGN OF EXPERIMENT AND SAMPLE SURVEY-I

UNIT I: ANALYSIS OF VARIANCE

Analysis of variance: One way and Two way classification; Two way classification with m observations per cell; Statistical analysis of these models. 14 (12L)

UNIT II: DESIGN OF EXPERIMENT

Principles of design of experiment: completely randomized design, randomized block design, Latin Square Design- assumptions, model, hypotheses, least square estimates of the parameters and statistical analysis. 14 (12L)

UNIT III: FACTORIAL EXPERIMENT

Factorial experiments: Analysis of 2^2 , 2^3 and 3^2 factorial experiments; Advantages of factorial over simple experiment with example. 14 (12L)

UNIT IV: SAMPLE SURVEY -I

Concepts of population and sample; Need for sampling; Census and sample survey – Advantages and Disadvantages; Basic principles of sample survey; Principal steps in a sample survey; Different types of sampling; Sampling and Non-sampling errors(Concepts only); Simple random sampling with and without replacement- Properties of the estimates and their variances; Simple random sampling for attributes. 14 (12L)

UNIT V: SAMPLE SURVEY -II

Stratified random sampling : Advantages and disadvantages , properties of the estimates and their variances; Optimum allocation, Proportional allocation; Variance of the sample estimates; Relative precision of stratified random sampling and simple random sampling; Systematic sampling (Definition); Cluster sampling (concept only); Idea of ratio and Regression estimates.

14 (12L)

SEMESTER-IV : Practicals (STPP – 402)

1. Experiments on one and two way classification of data.
2. Experiment on CRD.
3. Experiments of Randomized Block Design (RBD)
4. Experiments on Factorial experiments.
5. Problems on SRS for variables and attributes
6. Problems on Stratified sampling

Text Books :

1. Gupta S.C. and Kapoor V.K. (2001): Fundamentals of Applied Statistics, Sultan Chand & Sons.
2. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. II, World Press, Calcutta.
3. Singh Daroga and Choudhary F.S. (1986), Theory and analysis of Sample Survey Designs, Wiley Eastern Ltd.
4. Montgomery D.C.(2001): Design and Analysis of Experiments, John Wiley.
5. Cochran W.G. (1999), Sampling Techniques, Wiley Eastern Ltd.
6. Des Raj (2000) : Sample Survey, Narosa
7. Agarwala, A.K. & Chakraborty, S. (2009) : Statistics : A tutorial text with practicals, Kalyani Publisher
8. Das.M.N and Giri.N.C(1986): Design and Analysis of Experiments, Wiley Eastern Limited.
9. Mukherjee P : Theory and Methods of Survey Sampling, Prentice Hall of India.

SEMESTER-V Theory(STPT – 501)

UNIT-I: TIME SERIES ANALYSIS-I

Components of a time series; Evaluation of trend by least squares (Straight line, Second Degree parabola, Exponential curve, Gompertz curve) and methods of moving averages; Estimation of

Seasonal Variation: Simple average, Ratio to Moving Average, Ratio to Trend and Link Relative Method. 14 (12L)

UNIT-II: INDEX NUMBERS-I

Basic index numbers: their definitions, Main steps in the construction of index numbers; Laspeyre's, Paasche's, Fisher's, Marshall Edgeworth index numbers; Uses of index numbers; Fixed and Chain base index numbers; Base shifting, splicing and deflating of Index numbers; Uses and limitations of Index numbers. 14 (12L)

UNIT-III: STATISTICAL QUALITY CONTROL:

Statistical Process control: General theory of control charts; Causes of variation in quality; control limits, summary of out of control criteria; Charts for variables: \bar{X} & R charts; Charts for attributes: p- chart, np-chart, c-chart. 14 (12L)

UNIT-IV: DEMAND ANALYSIS

Demand Analysis, theory and analysis of consumer's demand; Law of demand, Equilibrium Price; Price elasticity of demand and supply and different forms of demand functions; Engel's Law and Engel's Curve; Pareto's law of income distribution. 14 (12L)

UNIT-V: VITAL STATISTICS

Sources of demographic data in India: census, registration vital events, survey; Measures of fertility: CBR, ASFR, GFR & TFR; Measures of population growth : GRR & NRR; Mortality :Measures of mortality: crude and specific rates (w.r.t. age, sex, infant mortality rate); Direct and indirect standardization of death rates. 14 (12L)

SEMESTER-V : Practicals(STPP – 502)

1. Measurement of trend by least squares method
2. Measurement of trend by moving average method
3. Measurement of seasonal indices by different methods
4. Construction of Laspeyre's, Paasche's, Marshall Edgeworth and Fisher index number
5. Problems on Time Reversal Test and Factor Reversal Test
6. Problems on equilibrium price and elasticity of demand
7. Problems on Pareto's law of income distribution
8. Construction of variable control charts
9. Construction of attribute control charts
10. Calculation birth and death rates : Crude and Standardized
11. Calculation of general and total fertility rates

12. Calculation of Gross and Net reproduction rates

Text Books :

1. Gupta S.C. and Kapoor V.K. (2001): Fundamentals of Applied Statistics, Sultan Chand & Sons.
2. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. II, World Press, Calcutta.
3. Gupta S.C. and Kapoor V.K. (2001): Fundamentals of Mathematical Statistics, Sultan Chand & Sons.

SEMESTER-VI : Theory(STPT – 601)

UNIT – I : OFFICIAL STATISTICS

Official Statistics relating to population and agriculture; Population census of India, Central Statistical Organization(CSO), Directorate of Economic and Statistics, National Sample Survey Office(NSSO); National Income and various methods of estimating national income. 14 (12L)

UNIT – II : DEMOGRAPHY:

Life table, Different types of Life tables; Complete and Abridged Life Table; Structure, interpretation and interrelationship of different columns of Life Table; Construction of Abridged Life table by Reed-Merrell and Greville's method; Uses of life table; Population projection by mathematical method : Logistic Curve, Makeham's method. 14 (12L)

UNIT – III : TIME SERIES ANALYSIS-II

Measurement of Cyclical Variation by Harmonic Analysis; Measurement of Random Component by variate difference method; Serial correlation and correlogram; Auto-regression series: 1st order Auto-regression; Auto-correlation and correlogram with examples. 14 (12L)

UNIT - IV : INDEX NUMBER-II

Cost of living index number, wholesale price index number, Industrial and agricultural index numbers : steps in construction of these indices and uses. 14 (12L)

UNIT – V :THEORY OF ATTRIBUTES

Analysis of Categorical data, consistency of categorical data; Independence and Association of Attributes ; Various measures of association for two-way and three way classified data; Odds Ratio. 14 (12L)

SEMESTER-VI : Practicals (STPP – 602)

1. Constructions of complete and abridged life tables.
2. Fitting of Logistic curve
3. Construction of Cost of living index number
4. Construction of Industrial index number.
5. Construction of contingency table.

Text Books :

1. Gupta S.C. and Kapoor V.K. (2001): Fundamentals of Applied Statistics, Sultan Chand & Sons.
2. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. II, World Press, Calcutta.
3. Gupta S.C. and Kapoor V.K. (2001): Fundamentals of Mathematical Statistics, Sultan Chand & Sons.

STATISTICS SYLLABUS OF SEMESTER SYSTEM FOR HONOURS

SEMESTER – I: Theory (STHT – 101)

MATHEMATICAL STATISTICS Marks = 100

(End Semester = 70 + Internal Assessment = 30)

UNIT-I : MATRICES

Matrices: Elementary, scalar, symmetric, skew symmetric, Hermitian, skew-Hermitian, unitary, triangular, equivalent and similar matrices (only definitions); Transpose and conjugate of a matrix ; Inverse of a matrix; Rank of a matrix, Determination of rank through elementary transformations; Solutions of systems of linear equations; 20 (18L)

UNIT-II : INTREGRAL CALCULAS

Double and Triple integrals : Evaluation in simple cases only; Jacobian of transformation and statistical applications; Maxima and Minima of functions of one and two variables; Lagrange's multiplier with examples ; beta , gamma integrals. 15 (12L)

UNIT - III : SET THEORY

Sets, operations on sets; Field and Partitions; Limit of sequence of sets (arbitrary and monotone); Equivalence of sets; Countable sets and examples; union and Cartesian product of countable sets; set functions and properties. 10 (9L)

UNIT - IV: SEQUENCE

Sequence of real numbers, Limit of a sequence - Bounded sequences, Convergent sequences, Divergent sequences, Monotone sequences. Convergence and divergence of series. 10 (9L)

UNIT - V: DIFFERENTIATION

Differentiation of one function with respect to another function; Differentiation involving parametric equations; Differentiation of implicit functions; Increasing and decreasing functions; Successive differentiation; Partial differentiation. 15 (12L)

SEMESTER-I : Practicals (STHP – 102)

1. Calculation of inverse of a matrix
2. Calculation of rank of a matrix
3. Solutions of systems of linear homogeneous and non homogeneous equations
4. Problems on double and triple integral
5. Problems on Jacobian of transformation
6. Finding of maxima and minima using Lagrange's multiplier
7. Problems on set theory
8. Problems on Convergence and divergence series
9. Problems of differentiation

Text Books :

1. Malik S.C. & Arora S. (2000) : Mathematical Analysis, New Age International
2. Shanti Narayan and Mittal P K (...) : Differential Calculus, S Chand and Co.
3. Shanti Narayan and Mittal P K (...) : Integral Calculus, S Chand and Co.
4. Das B.C. & Mukherjee B.N. : Differential Calculus, U.N. Dhar & Sons
5. Das B.C. & Mukherjee B.N. : Integral Calculus, U.N. Dhar & Sons
6. Apostol, T.M. (1985): Mathematical Analysis, Narosa Publishing House.
7. Khuri, A. I. (1983): Advanced Calculus with Applications in Statistics, Wiley.
8. Srieddon Ian N (1972) : The Use of Integral Transform, McGraw Hill Publications.
9. Raisinghania M.D. : Laplace and Fourier Transforms, S. Chand & Co.

SEMESTER-II : Theory (STHT – 201)

UNIT - I: NUMERICAL ANALYSIS

Central Difference: Idea, Operator's, Gauss's forward, backward, Bessel, Everret and Stirling formulae ; Derivation of reminder terms in different interpolation formulae; Inverse Interpolation; Numerical Differentiation; Numerical Integration: Simpson's 3/8 th rule, Weddle's rule [Proof of all the formulae will be required]. 14 (12L)

UNIT - II: DIFFERENCE EQUATION

General properties of linear difference equation; linear difference equation with constant coefficient; Roots of polynomial equations, and solution of simple problems by Newton- Raphson method, Bisection method, and Graphical method, Regula Falsi Method, Method of Iteration. 14 (12L)

UNIT – III : VECTOR ALGEBRA

Definition of vectors, Algebra of vectors, Linear dependence and linear independence of Vectors; A vector as a linear combination of vectors- their independence and dependence; hyperplanes; basis, dimension, properties of convex sets; Eigen values and Eigen vectors and their related theorems; Cayley-Hamilton theorem; Quadratic forms- definition and classification only. 14 (12L)

UNIT - IV : LINEAR PROGRAMMING AND TRANSPORTATION PROBLEM

Linear Programming problem (LPP): Problem formulation and solution using graphical and simplex method; Transportation Problem: Definition and its solution using lowest cost entry (matrix minima), north west corner rule and Vogel's approximation method. 14 (12L)

UNIT – V : DISTRIBUTION THEORY

Beta and Gamma distribution; Exponential , Weibul and Log-normal distribution with their properties and applications. 14 (12L)

SEMESTER-II : Practicals (STHP – 202)

1. Gauss's forward, backward, Bessel, Everret and Stirling formulae, Simpson's 3/8 th rule, Weddle's rule
2. Roots of polynomial equations, and solution of simple problems by Newton- Raphson method, Bisection method, and Graphical method, Regula Falsi Method

3. Estimation of eigen values and eigen vectors
4. Problems on Cayley-Hamilton theorem
5. Problem formulation and solution using graphical and simplex method
6. Transportation Problem: solution using lowest cost entry (matrix minima), north west corner rule and Vogel's approximation method
7. Problems on Exponential , Weibul and Log-normal distribution

SEMESTER – III : Theory (SHT – 301)

UNIT – I : ESTIMATION THEORY

Cramer-Rao inequality and its uses, Cramer – Rao lower bound, Rao –Blackwell Theorem; Method of estimation – Maximum Likelihood Estimation (MLE), Method of moments, Method of Minimum Chi-Square. 14 (12L)

UNIT – II : INTERVAL ESTIMATION

Concept of Confidence Interval and confidence Co-efficients, Confidence interval for the parameters of univariate Normal, Bi-variate Normal and one-parameter exponential distribution. 14 (12L)

UNIT – III : TESTING OF HYPOTHESIS

Most powerful (Best)Critical Region (MPCR), Uniformly Most powerful (Best)Critical Region (UMPCR) and their tests; Unbiased and uniformly most powerful unbiased test, Neyman – Pearson lemma and its application in testing hypothesis regarding Binomial, Poisson, Normal and Exponential Distribution. 14 (12L)

UNIT – IV : LIKELYHOOD (LR) RATIO TEST

Tests for mean and variance of one, two and several independent normal population; Sequential Tests, Wald's sequential probability Ratio Test (SPRT). 14 (12L)

UNIT – V : NON-PARAMETRIC (NP)TESTS

Concept of Non-parametric(NP) Tests, Advantages and disadvantages of NP Tests over Parametric Tests, Introduction of Sign test, Median test, Wald-Wolfowitz Run Test, Test for Randomness, Mann-Whitney U Test, Simple illustrative examples of applications, 14 (12L)

SEMESTER-III : Practicals (STHP – 302)

1. Problems on Cramer-Rao lower bound
2. Problems on Maximum Likelihood Estimation (MLE) and Method of moments
3. Finding out Confidence Interval and confidence Co-efficient
4. Problems on Bi-variate Normal and one-parameter exponential distribution
5. Application of Neyman –Pearson lemma
6. Sign test, Median test, Wald-Wolfowitz Run Test, Test for Randomness, Mann-Whitney U Test

Text Books:

1. A M Goon , M K Gupta, B Dasgupta . Fundamental of Statistics, Vol & 2, World Press
2. E J Dudewicz, S N Mishra. Modern Mathematical Statistics,
3. S.C. Gupta, V.K. Kapoor, Fundamental of mathematical Statistics, Sultan Chand & Co.
4. P Mukhopadhyay. Applied Statistics, New Central Book Agency
5. A M Mood, F A Graybill, D C Boes. Introduction to the Theory of Statistics,
6. R V Hogg, A T Craig. Introduction to Mathematical Statistics, Collier Macmillan
7. F S Hiller , G J Libermann. Introduction to Operations Research, Mc Graw Hill

SEMESTER - IV : Theory (STHT – 401)

UNIT – I : ORDER STATISTICS

Definition and uses of order Statistics, derivation of the distribution of r th ordered statistic, joint distribution of the r^{th} & s^{th} order statistics, distribution of sample range and sample median. 10 (9L)

UNIT – II : MULTIVARIATE ANALYSIS

Bivariate Normal Distribution and its properties; Marginal and Conditional distributions, independence; Multivariate Normal distribution, marginal and conditional distribution, independence, characteristic function; Hotelling T^2 – idea and application (without derivation). 15 (12L)

UNIT – III : COMPUTER PROGRAMMING

Basic idea of different parts of a computer, brief idea of software, hardware; high level languages. Flowchart symbols and their uses, construction of Algorithms. Programming in

Fortran 77: Fortran constants, Fortran variables (real and integer), type declaration statements, arithmetic operations, hierarchy of operations, real, integer and mixed mode arithmetic, use of simple built-in library functions, simple input-output statements without format statement, Use of Logical IF, Block IF and Arithmetic IF statements, use of DO loops, Nested Do loops and statement. Writing small programs for determination of commonly used statistical measures and for carrying out simple statistical analysis. 20 (18L)

UNIT – IV : EDUCATIONAL STATISTICS

Scaling of individuals for items in terms of difficulty. Z-Score, Standard scores, Normalized Scores T-Score and Percentile Score. Scaling of rating in terms of Normal probability curve. Test theory, Methods of estimating test reliability. Effect of test length on reliability of a test. Validity of test scores. Intelligent Quotient and its construction. 15 (12L)

UNIT – V : SIMULATION

Introduction, Definition, types, uses and limitations of simulation techniques. Phases of simulation model. Even type simulation model with examples. Generation of random numbers. Monte-Carlo simulation. 10 (9L)

SEMESTER-IV : Practicals (STHP – 402)

1. Problems on Bivariate and Multivariate Normal distribution and M.L.E. of Multivariate Normal distribution
2. Writing small programs for determination of commonly used statistical measures and for carrying out simple statistical analysis.
3. Finding out Z-Score, Standard scores, Normalized Scores T-Score and Percentile Score
4. Problems using scaling of rating in terms of Normal probability curve
5. Problems on Effect of test length on reliability of a test
6. Problems on simulation

Text Books:

8. A M Goon , M K Gupta, B Dasgupta . Fundamental of Statistics, Vol & 2, World Press
9. S. D. Sharma, Operations Research, Kedarnath Ramnath & Company, Meerut
10. E J Dudewicz, S N Mishra. Modern Mathematical Statistics,
11. S.C. Gupta, V.K. Kapoor, Fundamental of mathematical Statistics, Sultan Chand & Co.
12. P Mukhopadhyay. Applied Statistics, New Central Book Agency
13. A M Mood, F A Graybill, D C Boes. Introduction to the Theory of Statistics,
14. R V Hogg, A T Craig. Introduction to Mathematical Statistics, Collier Macmillan
15. H A Taha. Operations Research, Macmillan Publishing
16. F S Hiller , G J Libermann. Introduction to Operations Research, Mc Graw Hill

SEMESTER - V : Theory (SHT – 501)

SAMPLE SURVEY AND DESIGN OF EXPERIMENT

UNIT – I : SAMPLE SURVEY-I

Systematic sampling , Variances of the estimated mean Populations with linear Trend, Relative precision of systematic, stratified random and simple random sampling. Cluster sampling with clusters of equal sizes, , Sources of sampling and non-sampling error and ways to control, Pilot Survey and its Importance 14 (12L)

UNIT – II : SAMPLE SURVEY -II:

Two stage sampling and multistage sampling, two phase and multiphase sampling(concept only), PPS sampling; Ratio and Regression method of Estimation, estimation of population mean, total and variance. 14 (12L)

Unit – III : LINEAR MODELS AND ANCOVA

Theory of linear estimation, Estimability of linear parametric function and BLUE; Method of least squares, Gauss Markov Theorem; Estimation of error variance; Analysis of covariance one-way and two-way layout and their statistical analysis and the computational shortcuts; Test for the linearity of regression; Test for the homogeneity of a group of regression coefficients. 14 (12L)

UNIT – IV : DESIGN OF EXPERIMENT

Concept and procedure of missing plot technique, Estimation of missing yield in case of one and two missing plots in R.B.D. and L.S.D. , Finding the standard error (S.E.) of difference between two treatments under one of which there is a missing plot and under the other there is none; Split-Plot Design; Balanced incomplete Block Design(BIBD)(simple concepts only). 14 (12L)

UNIT – V : CONFOUNDING AND ORTHOGONALITY OF DESIGN

Concept of confounding in a design of experiment, confounding subgroups, determination of suitable confounding subgroups, complete and partial confounding with examples considering 2^3 or 2^4 experiment; Orthogonality of classification in two-way layouts, simple illustrations. 14 (12L)

SEMESTER-V : Practicals (STHP – 502)

1. Experiments on Systematic sampling
2. Experiments on relative precision of systematic sampling over stratified and simple random sampling
3. Problems on two stage sampling and PPS sampling
4. Experiments on Ratio and Regression method of Estimation
5. Experiments on analysis of covariance : one-way and two-way(RBD) classified data
6. Experiments on missing plot technique: Estimation of missing yield in case of one and two missing plots in R.B.D. and L.S.D.
7. Experiments on complete and partial confounding design: 2^3 and 2^4 experiment

Text Books :

1. Cochran W.G. (1999) : Sampling Techniques, Wiley Eastern Ltd.
2. Gupta S.C. and Kapoor V.K. (2001) : Fundamentals of Applied Statistics, Sultan Chand and Sons.
3. Mukherjee P (...) : Theory and Methods of Survey Sampling ,Prentice Hall of India.
4. Singh Daroga and Choudhary F.S. (1986) : Theory and analysis of Sample Survey Designs, Wiley Eastern Ltd.
5. Gupta S.C. and Kapoor V.K. (2001) : Fundamentals of Applied Statistics, Sultan Chand and Sons.
6. Sukhatme Pandurang V. and Sukhatme Balkrishna V. (1970): Sampling Theory of Survey with application, Asia Publication House. 18
7. Des Raj (2001) : Sample Survey, Narosa
8. Sukhatme B.V. (1984) : Sample Survey Methods and its Applications, Indian Society of Agricultural Statistics
9. Kempthorne O (1965) : The Design and Analysis of Experiments, Wiley

SEMESTER-VI : Theory (STHT - 601)

CHOICE BASED PAPER

Operations Research(OR) and SQC (Or, Sampling Inspection Plans)

UNIT – I : STOCHASTIC PROCESSES

Definitions and examples of stochastic processes (Its applications in various fields –other than mathematical applications), classification of general stochastic process into discrete, continuous

time, discrete continuous state space; Elementary problems, definition and examples of Markov chain, transition probability matrix- its construction and applications; Chapman Kolmogorov equation, classification of states. 20 (18L)

UNIT – II : INVENTORY MODELS

Concept of planned inventory policies, ABC Analysis, Deterministic model policy when inventory levels are reviewed continuously and demand occurs uniformly with and without shortage cost, Economic order quantity for production planning when inventory models are reviewed periodically(with and without shortage). (Multi item models, uncertain and stochastic demand models are not required) 15 (12L)

UNIT – III : NETWORK + C.P.M. + PERT

Network: Idea of Network node, activities, dummy activity, construction of network diagram. C.P.M: Network scheduling using C.P.M: determination of different types of floats and slacks, determination of Critical path. PERT: Basic definition of PERT and its usefulness; brief idea of optimistic time, pessimistic time and most likely time (PERT calculations are not required) 10 (9L)

UNIT – IV : QUEUING THEORY

Transient and Steady States, Poisson Process, Pure Birth and Pure Death Process, Queuing systems, (M/M/1):(∞/FCFS) , Simple Problems. 10 (9L)

UNIT – V : STATISTICAL QUALITY CONTROL (SQC) – PRODUCT CONTROL

Producer's and Consumer's risks, Acceptance Quality Level (AQL), Lot Tolerance Percentage Defective (LTPD), Process Average Fraction Defective. Sampling Inspection plan : Single and Double sampling Inspection plan. OC, ASN, ATI, AOQ and AOQL Functions of Single and Double sampling Inspection plans.; Sequential Sampling Inspection plan and Sequential Probability Ratio Test (SPRT); OC, ASN, Functions of SPRT 15 (12L)

Text Books :

1. H A Taha. Operations Research, Macmillan Publishing
2. S. D. Sharma, Operations Research, Kedarnath Ramnath & Company, Meerut.
3. F S Hiller , G J Libermann. Introduction to Operations Research, Mc Graw Hill
4. J Medhi. Stochastic Process, Wiley

5. G Hoel , S C Port, C J Stone. Introduction to Stochastic Process, Universal Book Stall
6. S Karlin, H M Taylor. A First Course in Stochastic Process, Academic Press
7. Feller, W., An Introduction to Probability Theory and is Applications, Wiley.
8. Gupta S.C. and Kapoor V.K. (2001) : Fundamentals of Applied Statistics, Sultan Chand and Sons.
9. Goon A.M, Gupta M.K., Das Gupta B. (1991): Fundamentals of Statistics, Vol. II, World Press, Calcutta.

SEMESTER-VI : PROJECT (STHP – 602)
N.B. - Project Topic will be selected on time.

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