ALGEBRA

I - M.Sc(STATISTICS) / I - Semester

Choice Based Credit System(CBCS)

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Syllabus for I - MSc(*STATISTICS*)

Paper I : Algebra

I.GROUP THEORY

Homomorphisms, Automorphisms, Cayleys theorem, Permutation groups, Another counting principle. Sylow's theorem, Direct products, Finite abelian groups. (3 Questions to be set).

II. RING THEORY

Rings, Some special classes of rings, Homomorphisms, Ideals and quotients of an integral domain, Euclidean rings. The field of quotients of an integral domain, Euclidean rings, a particular Euclidean ring, polynomial rings, polynomial over the rational field, polynomial rings over the commutative rings. (2 Questions to be set).

III.FIELDS

Extension fields, Roots of polynomials, Construction with straight edge and compass, More about roots, the elements of Galois theory, Solvability by radicals, Galois groups over the rationals. (3 Questions to be set).

IV. LATTICES

Partially ordered sets, Lattices, Modular Lattices, Schreier's theorem. The Chain conditions decomposition theory for Lattices with ascending chain condition, Independence, complemented modular lattices, Boolean algebras. (2 Questions to be set).

Text Books:

1 .Topics in Algebra by I.N. Horstein (2nd Edition), Vikas Publishing House Pvt.Ltd.

2. Lectures in Abstract Algebra by Nathan Jacobson, D. Van Nostrand Company,Inc.

Probability and Distributions

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Unit-I

Unit-III

Unit-IV

First Year - M.Sc (Statistics)

PAPER - II: Probability and Distributions

Unit –I

Descriptive Statistics: Concept of primary and secondary data. Methods of collection and editing of primary data. Designing a questionnaire and a schedule. Sources and editing of secondary data. Classification and tabulation of data. Measures of central tendency (mean, median, mode, geometric mean and harmonic mean) with simple applications. Absolute and relative measures of dispersion (range, quartile deviation, mean deviation and standard deviation) with simple applications. Importance of moments, central and non-central moments, and their interrelationships, Sheppard's corrections for moments for grouped data. Measures of skewness based on quartiles and moments and kurtosis based on moments with real life examples.

Probability: Basic concepts in probability deterministic and random experiments, trail, outcome, sample space, event, and operations of events, mutually exclusive and exhaustive events, and equally likely and favourable outcomes with examples. Mathematical, statistical and axiomatic definitions of probability with merits and demerits. Properties of probability based on axiomatic definition. Conditional probability and independence of events. Addition and multiplication theorems for n events. Boole's inequality and Bayes' theorem. Problems on probability using counting methods and theorems.

Unit –II

Random Variables: Definition of random variable, discrete and continuous random variables, functions of random variables, probability mass function and probability density function with illustrations. Distribution function and its properties. Transformation of one-dimensional random variable (simple 1-1 functions only). Notion of bivariate random variable, bivariate distribution and statement of its properties. Joint, marginal and conditional distributions. Independence of random variables.

Mathematical Expectation: Mathematical expectation of a function of a random variable. Raw and central moments and covariance using mathematical expectation with examples.

Addition and multiplication theorems of expectation. Definition of moment generating function (m.g.f), cumulant generating function (c.g.f), probability generating function (p.g.f) and characteristic function (c.f) and statements of their properties with applications. Chebyshev's , and Cauchy-Schwartz's inequalities and their applications. Statement and applications of weak law of large numbers and central limit theorem for identically and independently distributed (i.i.d) random variables with finite variance.

Unit –III

Discrete Distributions: Uniform, Bernoulli, Binomial, Poisson, Negative binomial, Geometric and Hyper-geometric (mean and variance only) distributions. Properties of

these distributions such as m.g.f, c.g.f., p.g.f., c.f., and moments up to fourth order and their real life applications. Reproductive property wherever exists. Binomial approximation to Hyper-geometric, Poisson approximation to Binomial and Negative binomial distributions.

Unit –IV

Continuous Distributions: Rectangular and Normal distributions. Normal distribution as a limiting case of Binomial and Poisson distributions. Exponential, Gamma, Beta of two kinds (mean and variance only) and Cauchy (definition and c.f. only) distributions. Properties of these distributions such as m.g.f., c.g.f., c.f., and moments up to fourth order, their real life applications and reproductive productive property wherever exists.

Design and Analysis of Experiments

I - M.Sc(STATISTICS) / I - Semester

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Unit-II

Unit-III

First Year - M.Sc (Statistics)

PAPER - III: Design and Analysis of Experiments

Unit – I: Design of Sample Surveys

Concepts of population, sample, sampling unit, parameter, statistic, sampling errors, sampling distribution, sample frame and standard error. Principal steps in sample surveys - need for sampling, census versus sample surveys, sampling and non- sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling.

Types of Sampling: Subjective, probability and mixed sampling methods. Methods of drawing random samples with and without replacement. Estimates of population mean, total, and proportion, their variances and the estimates of variances in the following methods.

(i) SRSWR and SRSWOR

(ii) Stratified random sampling with proportional and Neyman allocation, and

(iii) Systematic sampling when N= nk.

Comparison of relative efficiencies. Advantages and disadvantages of above methods of sampling.

Unit – II: Analysis of Variance and Design of Experiments

ANOVA – one-way, two-way classifications with one observation per cell –concept of Gauss-Markoff linear model, statement of Cochran's theorem, concept of fixed effect model and random effect model. Expectation of various sums of squares, Mathematical analysis, importance and applications of design of experiments. Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of above designs.

Unit – III: Time Series, Index Numbers and Official Statistics

Time Series: Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares, moving average methods. Growth curves and their fitting- Modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

Index Numbers: -Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.

Official Statistics: - Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics. National Income and its computation, utility and difficulties in estimation of national income.

Unit –IV: Vital statistics:

Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate if natural increase-Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables.

Demand Analysis: Introduction. Demand and supply, price elastics of supply and demand. Methods of determining demand and supply curves, Leontief's ,Pigous's methods of determining demand curve from time series data, limitations of these methods Pigou's method from time series data. Pareto law of income distribution curves of concentration.

Python

I - M.Sc(STATISTICS) / I - Semester

Choice Based Credit System(CBCS)

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Python

Course outcomes

After successful completion of this course, the students will be able to:

CO 1: Summarize the fundamental concepts of python programming. [K2]

CO 2: Interpret object oriented and event driven programming in python. [K2]

CO 3: Apply the suitable data structures to solve the real time problems. [K3]

CO 4: Apply regular expressions for many different situations. [K3]

Unit-I

Introduction to python: Numbers, strings, variables, operators, expressions, Indentation, String operations and functions, math function calls, Input/output statements, conditional if, while and for loops,

Unit-II

Functions: user defined functions, parameters to functions, recursive functions, and lambda function.

Event driven programming: Turtle graphics, Turtle bar chart, Widgets, key press events, mouse events, timer events.

Unit-III

Data structures: List- list methods & functions, Tuple-tuple methods & functions, Dictionaries-dictionary methods & functions, traversing dictionaries. Sets-methods & functions, Files

Unit-IV

OOP: class, object, methods, constructors, inheritance, inheritance types, polymorphism, operator overloading, abstract classes, exception handling.

Unit-V

Regular expressions: Power of pattern matching and searching using regex in python, Meta characters and Sequences used in Patterns, Password, email, URL validation using regular expression, Pattern finding programs using regular expression.

Python

Chapter-1: Introduction

STATISTICAL INFERENCE

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Unit-IV

First Year - M.Sc (Statistics)

PAPER IV- STATISTICAL INFERENCE

Unit – I

Population correlation coefficient and its properties. Bivariate data, scattered diagram, sample correlation coefficient, computation of correlation coefficient for grouped data.

Correlation ratio, Spearman's rank correlation coefficient and its properties. Principle of least squares, simple linear regression, correlation verses regression, properties of regression coefficients. Fitting of quadratic and power curves. Concepts of partial and multiple correlation coefficients (only for three variables). Analysis of categorical data, independence and association and partial association of attributes, various measures of association (Yule's) for two way data and coefficient of contingency (Pearson and Tcherprow), coefficient of colligation.

Unit – II

Concepts of population, parameter, random sample, statistic, sampling distribution and standard error. Standard error of sample mean(s) and sample proportion(s). Exact sampling distributions- Statement and properties of χ^2, t and F distributions and their interrelationships. Independence of sample mean and variance in random sampling from normal distributions.

Point estimation of a parameter, concept of bias and mean square error of an estimate. Criteria of good estimator- consistency, unbiasedness, efficiency and sufficiency with examples. Statement of Neyman's Factorization theorem, derivations of sufficient statistics in case of Binomial, Poisson, Normal and Exponential (one parameter only) distributions. Estimation by method of moments, Maximum likelihood (ML), statements of asymptotic properties of MLE. Concept of interval estimation. Confidence intervals of the parameters of normal population by Pivot method.

Unit – III

Concepts of statistical hypotheses, null and alternative hypothesis, critical region, two types of errors, level of significance and power of a test. One and two tailed tests, test function (non-randomized and randomized). Neyman-Pearson's fundamental lemma for Randomized tests. Examples in case of Binomial, Poisson, Exponential and Normal distributions and their powers. Use of central limit theorem in testing. Large sample tests and confidence intervals for mean(s), proportion(s), standard deviation(s) and correlation coefficient(s).

Unit – IV

Tests of significance based on χ^2, t and F. χ^2-test for goodness of fit and test for independence of attributes. Definition of order statistics and statement of their distributions.

Non-parametric tests- their advantages and disadvantages, comparison with parametric tests. Measurement scale- nominal, ordinal, interval and ratio. One sample runs test, sign test and Wilcoxon-signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test, Wald Wolfowitz's runs test.

OPERATION RESEARCH

I - M.Sc(STATISTICS) / II - Semester
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UNIT - I

UNIT - II

Lesson 3

Lesson 4

UNIT - III

UNIT - IV

UNIT - V

Syllabus for I - MSc (*STATISTICS*)

Paper VI : OPERATION RESEARCH

UNIT- 1

Linear Programming problem Mathematical formulation, assumptions in linear programming, graphical method of solution, simplex method, Big-M method and Two phase method, Dual simplex method.

Unit-2

Integer Programming Introduction, Gomory's cutting plane method, Fractional cut method-Mixed integer and branch and bound techniques.

Transportation Problem-General transportation problem, Finding an initial basic feasible solution, Loops in transportation tables, Degeneracy, Optimality method-MODI method.

Assignment Problem- Hungarian Method, Traveling salesman problem.

Unit-3

Game theory Introduction, two-person zero-sum games, some basic terms, the maxmini-minimax principle, games without saddle points-Mixed Strategies, graphic solution of 2 * n and m*2 games, dominance property.

Simulation Introduction, Definition of Monte-Carlo Simulation.

Unit-4

Dynamic Programming Introduction, The Recursive equation approach, Algorithm, Solution of a L.P.P by Dynamic Programming.

Sequencing Models-Processing n jobs through 2 machines, n jobs through 3 machines, two jobs through m machines.

Networking Analysis CPM & PERT – Network minimization, shortest route problem, maximal-flow problem, Project scheduling, critical path calculations, PERT calculation.

Unit-5

Queuing Theory Introduction, Queuing system, Elements of Queuing system, Characteristics of Queuing system, Classification of Queuing Models, Poisson Queuing systems-Model I (M/M/1): (∞ :FIFO)-Characteristics of Model I and waiting time characteristics. Characteristics of (M/M/1):(N/FIFO), (M/M/C):(∞ /FIFIO), (M/M/C):(N/FIFO)-all without derivation

Suggested Readings:

1. Operation Research by Kanti Swarup, P.KGuptha , Man Mohan 11th edition Sultan Chand & Sons Publication.
2. Operation Research , Jaico Publishing House
3. Operation Research-An introduction by Hamdy A Taha. Prentice Hall.
4. Introduction To Management Science, Anderson, Thomson Learning, 11Edn.
5. Operation Research Applications and Algorithms, Winston, Thomson Learning, 4Edn.
6. Introduction to Operation Research by Hiller/Lieberman. McGraw Hill.

Problem Solving in 'C'

As per Choice Based Credit System (CBCS)

I - M.Sc(STATISTICS) / II - Semester

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Problem Solving in 'C'

Outcomes

Upon successful completion of the course, a student will be able to:

1. Understand the evolution and functionality of a Digital Computer.
2. Apply logical skills to analyse a given problem.
3. Develop an algorithm for solving a given problem.
4. Understand 'C' language constructs like Iterative statements, Array processing, Pointers, etc.
5. Apply 'C' language constructs to the algorithms to write a 'C' language program.

Unit-I

General Fundamentals: Introduction to computers: Block diagram of a computer, characteristics and limitations of computers, applications of computers, types of computers, computer generations.

Introduction to Algorithms and Programming Languages: Algorithm - Key features of Algorithms, Flow Charts, Programming Languages - Generations of Programming Languages - Structured Programming Language- Design and Implementation of Correct, Efficient and Maintainable Programs.

Unit-II

Introduction to C: Introduction - Structure of C Program - Writing the first C Program - File used in C Program - Compiling and Executing C Programs - Using Comments - Keywords - Identifiers - Basic Data Types in C - Variables - Constants - I/O Statements in C - Operators in C - Programming Examples.

Decision Control and Looping Statements: Introduction to Decision Control Statements - Conditional Branching Statements - Iterative Statements - Nested Loops - Break and Continue Statement - Goto Statement

Unit-III

Arrays: Introduction - Declaration of Arrays - Accessing elements of the Array - Storing Values in Array - Operations on Arrays - one dimensional, two dimensional and multi dimensional arrays, character handling and strings.

Unit-IV

Functions: Introduction - using functions - Function declaration/ prototype - Function definition - function call - return statement - Passing parameters - Scope of variables - Storage Classes - Recursive functions.

Structure, Union, and Enumerated Data Types: Introduction - Nested Structures - Arrays of Structures - Structures and Functions - Union - Arrays of Unions Variables - Unions inside Structures - Enumerated Data Types.

Unit-V

Pointers: Understanding Computer Memory - Introduction to Pointers - declaring Pointer Variables - Pointer Expressions and Pointer Arithmetic - Null Pointers - Passing Arguments to Functions using Pointer - Pointer and Arrays - Memory Allocation in C Programs - Memory Usage - Dynamic Memory Allocation - Drawbacks of Pointers

Files: Introduction to Files - Using Files in C - Reading Data from Files - Writing Data to Files - Detecting the End-of-file - Error Handling during File Operations - Accepting Command Line Arguments.

Content

Problem Solving in 'C'

Analysis

I - M.Sc(STATISTICS) / II - Semester

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CONTENTS

Syllabus for I - M.Sc(*STATISTICS*)

Paper – VIII : Analysis

I. Finite, countable and uncountable sets - Metric spaces - Compact sets -Perfect sets Connected sets. (2 questions to be set)

II. Sequences in metric spaces Subsequences - Cauchy sequences - Upper and lower limits - Some special sequences. Absolute convergence - Addition and multiplication of series Rearrangements. (1 question to be set).

III. Continuity - Limits of functions Continuous functions Continuity and compactness Continuity and connectedness Discontinuities Monotornic functions Infinite and limits at infinity. (1 question to be set).

IV. Riemann Stieltjes integral Definition and existences of integral - Properties of integral - Intergation and differentiation. (2 questions to be set).

V. Sequences and series of functions Uniform convergence - Uniform convergence and continuity - Uniform convergence and integration - Uniform convergence and differentiation - Equicontinuous family of functions - Weierstrass approximation theorem. (2 questions to be set).

The Lebeggue theory - Set functions A construction of the Lebessque measure - measure spaces -Measurable functions - Simple function - Integration - Comparison with Riemann integral - Integration of complex function - Functions of class L2. (2 questions to be set).

Text Books:

Walter Rudin: Principle of Mathematical Analysis (Third Edition) Mc. Graw Hill International Edition.