

STATISTICS & OPERATIONS RESEARCH SUBJECT AREA

100 LEVEL COURSES

ST 101 Introduction to Statistics (3 credits)

Basic ideas in Statistics : Representation of data, Histogram, Frequency polygon, Ogive.

Measures of Location : Various Means (AM, GM, HM, TM), Median, Mode, Quantiles, Deciles, Percentiles. Measures of Dispersion : Range, Interquartile range, Variance, Standard deviation, Chebyshev's rule for sample, Sheppard's correction for variance, Coefficient of variance, Moments of higher order, Skewness, Kurtosis.

Representation of data using Stem-Leaf diagrams and Box plots.

Regression and Correlation: Scatter diagrams, Linear Regression, Method of least squares, Correlation, Coefficient of correlation, Rank correlation, Spearman's rank correlation coefficient.

Index numbers: Introduction, Price Relatives, Quantity Relatives and Value Relatives. Link and Chain Relatives, Cost of living Index Numbers, Methods of construction of Index Numbers, Quantity Index Numbers, Tests for Index numbers.

Recommended texts

1. *Statistical methods*, J. Medhi.
2. *A Basic Course in Statistics*, G.M. Clarke, and D. Cooke

ST 102 Introduction to Probability Theory (3 credits)

Counting Techniques: Combinations, Permutations, Set partitions,

Elements of Probability: Experiments, Events, Sample space, Laws of Probability, Bayes' Theorem, Independence of events. Random variables: Discrete and continuous r.v.'s, Probability mass function, Probability density function, Cumulative distribution function, Functions of a random variable, Expectation, Moments, Mean and variance, Moment Generating function.

Probability inequalities: Chebyshev's and Markov's etc.

Distributions: Discrete: Uniform, Bernoulli & Binomial, Poisson, Geometric, Negative Binomial, Hypergeometric, Multinomial, Continuous: Uniform, Normal, Gamma, Exponential, Properties and applications of distributions, Probability Generating functions.

Approximation to Binomial using Poisson, Binomial using Normal, and Poisson using Normal.

Recommended Texts

1. *Applied Probability and Statistical Methods*, G.C. Canovos .
2. *Basic Course in Statistics*, G.M. Clarke and D. Cooke
3. *A Course in Probability & Statistics*, C.J. Stone

ST 103 Statistics Applications I (1 credit)

(Prerequisite: ST 101 or any other Basic Statistics course)

Introduction to MINITAB, Data management: Editing, summarizing, Transforming and Manipulating Data, Graphical methods for describing data, Numerical methods for describing data, Distributions and Random data. Applications.

Recommended Text

1. *MINI TAB Reference manual*

ST 104 Statistics Applications II (1 credit)

(Prerequisite: ST 101 or any other Basic Statistics course)

Introduction to the SAS Display manager system, Structure of a SAS program, Editing, rearranging, displaying and summarizing data using PROC PRINT, PROC SORT, PROC FREQ, PROC MEANS, PROC UNIVARIATE, PROC FORMAT, PROC CORR PROC TABULATE, PROC STANDARD, PROC RANK etc. Creating Graphics using PROC PLOT, PROC CHART etc.

SAS Expressions, SAS Functions, Some SAS statements (ARRAY, DELETE, DO, DROP, FORMAT, GO TO, IF, INFILE, INFORMAT, INPUT, KEEP, LABEL MERGE, OUTPUT, PUT, SET, ID, VAR, TITLE, LIBNAME ETC.) Applications.

Recommended texts:

1. *SAS Reference manual*

CS 101 Introduction to Computer Science (3 credits)

Introduction and overview : Intelligent machines and systems applications, Business, Communications, Educational, Engineering, Environmental, Medical and Scientific applications.

Introduction to computing concepts : Basics of computer programming : data types, declarations, assignments, basic input and out put ASCII files, built-in functions.

Structured programming ideas : selection statements: sequence, iteration (counting loops, while loops, file pointers), conditional (if-then-else statements ,case statements) ,matrix manipulations (addition, subtraction, multiplication, transposition).

Modular programming : functions, procedures with actual and formal parameters, simple sort algorithms, dynamic memory allocation and addressing.

Numerical methods: Linear interpolation, linear regression, pseudo random , roots of functions, solutions of simultaneous linear equations by Gaussian elimination, numerical integration.

Recommended Texts

1. The Thinking Ape: Evolutionary Origins of Intelligence, R. Byrne.
2. Intelligent Multimedia System : A Handbook for Creating Applications, R.M.Kaplan
3. Artificial Intelligence, E.Rich and K. Knight

CS 102 Programming Techniques (3 credits)

Basic concepts, basic components of programming languages, binding, simple algorithms operating on non-structured data, modularity in program construction.

Basics of constructing larger programs :abstraction and instantiation of program components, structured data (lists, stacks, queues, ordered binary trees), storing and accessing data structures, operations on mutable data, working with mutable data, object-based programming, data encapsulation

Recommended Texts:

1. *Data Structures, Algorithms, and Object-oriented Programming*, G.L. Heileman.
2. *Structured programming concepts*, K. Labudde

CS 104 Structured oriented Programming practical (1 credit)

(Prerequisites: CS101, CS102)

Language constructs: data declarations, loops, decision structures, input/output, files, subprograms / procedures, numeric and non-numeric data. Design and construction of software: top-down and bottom-up design, decomposition, structuring, design for reuse, documentation, study of examples, writing software as a team, using software from others.

Programming assignments: A variety of progressively more complex assignments

Recommended Texts:

1. *The C Programming Language*, 2nd Edition, by Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall, Inc., 1988.

CS105 Object oriented Programming practical (1 credit)

(Prerequisites: CS101, CS102)

Implementation of programs with object oriented language constructs: classes, objects, inheritance, aggregation, composition and polymorphism.

Recommended Texts:

1. *Developing Java Software*, 3rd Edition, by Russel Winder and Graham Roberts, published by John Wiley and Sons, 2006
2. *Java Programming: From the Beginning*, K. N. King, Georgia State University

MT 105 Real Analysis I (3 credits)

Real number system as a complete ordered field, Complex number system, Topology of the real line, Neighborhoods, Sequences and limits, Limit theorems, Monotonic Sequences, Limit Concept of a Real-Valued Function, Algebra of limits, Continuity, Monotonic functions, Differentiability, Role's Theorem, Mean-Value Theorems, L'Hospital's Rule, Riemann Integral and the basic properties. Fundamental theorem of Calculus, Improper integrals.

Recommended text:

1. *Elementary Real Analysis*, H.G. Eggleston
2. *Analysis*, S.R. Lay

MT 107 Mathematics for Operations Research (3 credits)

Vector methods: Introduction to vectors, Linear combinations, Linear dependence and independence, Bases and dimension, Scalar product, Vector product

Differential equations: First order ordinary differential equations, Exact equations, Higher order linear ordinary differential equations with constant coefficients

Linear Algebra: Preliminaries, Determinants, Simultaneous linear equations, Eigenvalues and eigenvectors, Matrix calculations, Special matrices, Range and null space, Decomposition of matrices, Quadratic forms. Differentiation of scalar functions of matrices.

Recommended Texts:

1. *Elementary Vector Analysis*, C.E. Weatherburn,(1982)
2. *A First Course in Differential Equations*, D.G. Zill, (1998)
3. *Linear Algebra*, K. Hoffman and R. Kunze, (1999)

MT 108 Operations Research I (2 credits)

Introduction to Operations Research, Operations Research methods: Probabilistic and Deterministic.

Recommended Text:

1. *Operations Research*, Kanti Swarup.(1987)

MT 109 Linear Programming (3 credits)

(Prerequisites: MT 107, MT 108)

Introduction, Convex sets and functions, The Simplex method, Big-M method, Revised simplex method, Dual simplex method, Sensitivity analysis, Introduction to LINGO.

Some practical assignments will be given for this course.

Recommended Text:

1. *Linear and Nonlinear Programming*, David G. Luenberger,(1997)
2. *Operations Research*, Kanti Swarup.(1987)