PRINCIPAL SUBJECT AREA

STATISTICS

200 LEVEL COURSES

ST 201 Probability Theory (3 credits)
(Prerequisites **:** ST 102)
Joint distribution of two (or more) discrete or continuous random variables, Marginal distribution, Conditional distribution, Independence of random variables, Expectation, Conditional expectation, Covariance, Correlation coefficient, Transformations involving two or more random variables, Probability density functions of (a) sum and difference, (b) product and quotient of two random variables,

Random samples, Empirical distributions, Order statistics, Distributions of MIN X_i, MAX X_i etc., Distributions of sample mean and sample variance; t, F and χ^2 distributions and their properties, Laws of large numbers, Central limit theorem.

Recommended Texts:
1. Canavos G.C. (1984), *Applied Probability and Statistical methods*
2. Freund J.E. (1994) *Mathematical Statistics,* Prentice Hall
3. Wackerly D. Mendenhall W. & Scheaffer R.L. (1995) *Mathematical Statistics with Applications,* Duxbury Press.

ST 202 Applied Statistics (3 credits)
(This course cannot be offered by students who offered ST 101 or ST 201. Some practical assignments will be given for this course.)
Types of data, Data summarization: Histogram, Frequency polygon, Ogive.
Measures of location, Measures of Dispersion, Representation of data using Stem-Leaf diagrams and Box plots. Some Statistical distribution functions and their properties.
Test of hypothesis, Estimation and tests on difference between two means and proportions, Tests on variances.
Simple linear regression and correlation, Lack of fit residual plots, Introduction to Analysis of variance, and analysis of two-way contingency tables.

Recommended Texts:
1. Harper W.M. (1991) S*tatistics*, ELBS
2. Moore D.S. (1995) *The basic practice of Statistics,* W.H. Freeman & Company
3. Bluman A.G. (1997) *Elementary Statistics,* McGraw Hill

ST 203 Theory of Statistics (3 credits)
(Prequisites**:** ST 201)
Estimation: Point estimation: Properties of estimators; Unbiasedness, Consistency, Relative efficiency, Efficiency, Sufficiency, Factorization theorem, Rao-Blackwell theorem, UMVUE, Exponential families, Cramer-Rao inequality, Methods of obtaining estimators; Method of moments, Maximum likelihood estimators etc.
Interval estimation: Constructing confidence intervals for population parameters under various assumptions, Tolerance limits.
Testing Hypothesis: Tests on population parameters, Tests on independent and paired samples, Neyman-Pearson lemma, Uniformly Most Powerful tests, Likelihood Ratio tests.
Some practical assignments will be given for this course

Recommended Texts:
1. Canavos G.C. *(1984) Applied Probability and Statistical methods, Little, Brown & Company.*
2. Freund J.E. *(1994) Mathematical Statistics, Prentice Hall*
3. Hogg R.V. *(1978) & Craig A.T., Introduction to Mathematical Statistics, Prentice Hall .*

ST 204 Sampling Techniques (2 credits)
(Prerequisites: ST 203)
Principal steps in a Sampling Survey, Probability sampling, Simple random sampling, Sampling proportions and percentages, The estimation of sample size, Stratified random sampling, Methods of allocations, Ratio estimators, Regression estimators, Introduction to Cluster sampling and Systematic sampling, Estimating the population size.
Some practical assignments will be given for this course

Recommended Texts:
1. Cochran W.G. (1977) *Sampling Techniques*, John Wiley & Sons.
2. Scheaffer R.L. (1996) *Mendenhall W., and Ott L., Elementary Survey Sampling*, Duxbury Press.

ST205 Statistical Simulation (2 credits)
(Prerequisites: ST203, CS102, CS103)
Introduction and overview of simulation analysis, Modeling and estimating input processes, Random-number generation, Generation of random variates, vectors, and processes, Statistical analysis of simulation output, Comparison, ranking, and selection of simulation models, Variance-reduction techniques, Designing simulation experiments, gradient estimation, and optimization, Monte Carlo simulation
Some practical assignments will be given for this course

Recommended Texts:
1. *Simulation Modeling and Analysis*, Law and Kelton (2003)
2. *Graphical Simulation Modeling and Analysis Using Sigma for Windows*, L.W. Schruben(2001)

ST206 Introduction to Data Mining (2 credits)
(Prerequisites: CS 101, ST 101)
Introduction, Basic Data Mining Tasks, Database / OLTP Systems, Fuzzy Sets and Fuzzy Logic, Information Retrieval, Decision Support Systems, Dimensional Modeling, Data Warehousing, OLAP, Web Search Engines, Statistics, Machine Learning, Pattern Matching.
Data Mining Techniques, A statistical perspective on Data Mining, Similarity Measures, Decision Trees, Neural Networks, Genetic Algorithms. Classification – Statistical Based Algorithms, Distance-Based Algorithms, Decision Tree Based Algorithms
Some practical assignments will be given for this course

Recommended Texts:
1. *Data Mining, Introductory and Advanced Topics*, M.H. Dunham (2003)
2. *Principles of Data Mining*, Hand DJ et al, MIT Press (2001)

MT 202 Real Analysis II (3 credits)
(Prerequisites: MTI05)
Cauchy sequences, Convergence tests, Absolute and conditional convergence, Power series Integration and differentiation of power series, Taylor series, Uniform continuity, Upper and lower Riemann integrals, Characterization of Riemann integral functions, Functions of several variables, Limits and continuity, Partial derivatives, Differentials, Chain rule, Extrema of functions of several variables, Lagrange Multipliers.

Recommended Texts:
1. S. R. Lay {1986), *Analysis An Introduction to Proof*, Prentice-Hall
2. T. M. Apostol (1974), *Mathematical Analysis*, Addison-Wesley

MT 204 Mathematical methods (3 credits)

***Differentiation of Vectors*:** Scalar and vector point functions and their partial derivatives with respect to coordinate variables, Gradient of a scalar point function; Directional derivative, Divergence and curl of a vector point function . ***Integration of Vectors*:** Line integrals and their evaluation using parametric representation, Surface integrals, Green's theorem in the plane Stokes theorem, Circulation and flux of a vector point function, Volume integrals, Divergence theorem, Irrotational and Solenoidal vector fields, Orthogonal Curvilinear Coordinates, Grad, Div, Curl in OCC, Cylindrical polar and spherical coordinate systems, Use of these coordinate systems in evaluation of surface and volume integrals. ***Special Solution of Laplaces Equation*:** Solutions in two-dimensions, Axi-symmetric solutions. ***Integral Transforms*:** Laplace transforms; Elementary Properties, Inverse Laplace transform and its properties, Convolution theorem and its use in evaluation of integrals, Uses of Special functions connected with Laplace transform, Evaluation of integrals using LT, Applications in ODE and integro-differential equations, Applications in PDE, Fourier Transforms; Infinite-Fourier sine/cosine transforms and their inverse formulae, Finite-Fourier sine/cosine transforms, Derivation of inverse formulae, Use of Fourier series, Boundary value problems-Use of Fourier transforms.

Recommended Texts:

1. M.R. Spiegel (1968), *Vector Analysis*, McGraw-Hill
2. M.D. Raisinghania (1997), *Vector Analysis*, S. Chand & Comp. Ltd.
3. M.D. Raisinghania (1995), *Integral Transforms*, S. Chand & Comp. Ltd.

MT 207 Numerical Analysis I (2 credits)

Difference equations, Solutions of equations in one variable: Bisection method, Fixed-point iteration, Newton-Raphson method, Error analysis for iterative methods. Interpolation and Polynomial Approximation: Taylor polynomials, Interpolation and Lagrange polynomial, Iterated interpolation, Divided differences, Hermite interpolation, Cubic spline interpolation. Numerical Differentiation and Integration: Numerical differentiation, Richardson's extrapolation, Elements of numerical integration.

Recommended Texts:

1. K. E. Atkinson (1998), *An Introduction to Numerical Analysis*, John Wiley

MT 209 Graph Theory (2 credits)

Isomorphism of Graphs, Paths, Circuits, Eulerian graphs, Hamiltonian graphs, Shortest path problem, Chinese postman problem, Directed graphs, Graph Colouring, Four colour problem, Proof of five colour theorem, Planar graphs, ***Trees and Searching:*** Properties of trees, Travelling salesman problem, Tree Analysis of sorting algorithms, Hall's Theorem, Transversal theory, Applications to game theory.

Recommended Texts:

1. F. Harary (1988), *Graph Theory*, Narosa Publishing House
2. R. J. Wilson (1996), *Introduction to Graph Theory*, Addison-Wesley Longman