STATISTICS & OPERATIONS RESEARCH SUBJECT AREA

300 LEVEL COURSE

ST 301 Regression Analysis (3 credits)
Some practical assignments will be given for this course. (Prequisite: ST 203)
Simple linear regression, Tests for regression coefficients, Interval estimation, Prediction, Analysis of variance approach, Diagnostic and remedial measures, Matrix approach to simple linear regression, Multiple regression, Polynomial regression. Introduction to logistic regression and nonlinear regression, Introduction to Time series Analysis.

Recommended texts
1. Myers R.H. (1990) *Classical and Modern Regression with Applications*, Duxbury Press
2. Neter J. (1990) wasserman W. & Kunter M.H., A*pplied Statistical Models*, Irwin Inc.
3. Christensen R. (1998) A*nalysis ofVvariance, Design and Regression*, Chapman & Hall/CRC

ST 302 Quality Control (2 credits)
Some practical assignments will be given for this course. (Prequisite: ST 203)
Control charts for mean, variance, range etc, Properties of control charts, Acceptance sampling procedures and consumer risks, Operating characteristic curves, Process capability analysis, Introduction to Quality assurance and acceptance control, Lot-by-Lot acceptance sampling by attributes, Acceptance procedure based on AQL, Other acceptance procedures, Continues acceptance sampling by attributes, Acceptance procedures for variable characteristics.

Recommended texts
1. Hansen B.L. (1987) & Ghare P.M., *Quality Control and Application*, Prentice Hall
2. Montogomery D.C. (1993) I*ntroduction to Statistical Quality Control*, John Wiley & Sons.

ST 303 Design and Analysis of experiments (3 credits)
Some practical assignments will be given for this course. (Prerequisite: ST 203)
Comparison of two samples (independent, dependent), One-way ANOVA: Assumptions, Normal theory, F-tests. Multiple comparisons: LSD method, Tuckey's method, Bon- ferroni method, Scheffe's method, Duncan's multiple range method.
Two-way ANOVA: Normal theory, Randomized block design, The two factor factorial, Multifactor Factorials, Confounding, Introduction to Analysis of covariance, Latin square.

Recommended texts
1. Jobson J.D. (1991) A*pplied multivariate data analysis, Vol. I : Regression and Experimental Design*, Springer
2. Neter J. (1990) Wasserman W. & Kunter M.H., A*pplied Statistical Models*, Irwin Inc.
3. Lindman H.R. (1992) A*nalysis of Variance in Experimental Design*, Springer Series.

ST 305 Multivariate Methods I (2 credits)
(Prerequisite: ST 203)
Properties of random vectors and Matrices, The Multivariate Normal distribution, Estimation of parameters in the Multivariate Normal distribution, Wishart distribution, Inferences on multivariate mean, and Hotelling's T^2 tests, Multivariate Analysis of Variance, Cluster Analysis.
Some practical assignments will be given for this course

Recommended Texts:
1. *Multivariate Statistics - A Practical Approach,* Flury B and Riedwel H,l (1998)
2. *Multivariate Statistical inference & Applications,* A.C. Rencher (1982)

ST 306 Data Analysis & Preparation of Reports (1 credit)
(Prerequisites: ST 301, ST 302)
Students will be grouped, and assigned instructors. The skills of data analysis, statistical software development and report writing will be given. Initially the student groups are given case studies. Gradually the students will be assigned small projects taken from Industry. At the end of the course students are expected to write reports of their findings.

Recommended Text:
1. *SAS Reference Manuals*

ST 307 Time series (2 credits)
(Prerequisites: ST 203, ST 301)
Introduction; Objectives of time series analysis, Components of time series, Traditional method of time series analysis; Estimation of trend, seasonal effect forecasting; Auto-correlation & Auto-covariance functions Correlogram; Probability models for time series; Stationary processes; Second order stationary processes; Purely random processes; Random walk; Moving average processes; Auto-regressive processes; Mixed models (ARMA, ARIMA); Estimation of parameters; Testing adequacy; Forecasting; Exponentially smoothing forecasting procedure; Non Stationary and Seasonal Time series models (SARIMA); Box-Jenkins forecasting procedure. Introduction to non linear models and Multivariate time series modelling
Some practical assignments will be given for this course

Recommended Texts:
1. *Introduction to Time Series and Forecasting*, P.J. Brockwell and R.A. Davis (2000)
2. *The Analysis of Time Series, An Introduction*, C. Chatfield (1998)

ST 308 Bayesian Statistics I (2 credits)
(Prerequisite: ST 203)
Introduction: Statistical and Non-statistical decisions, Profit, Loss, Risk and utility, Expected Value, Bayes' Theorem, Prior Distribution, Bayesian Inference; Non-statistical Decisions: Maximin, Maximax, Minimax Regret and Hurwicz.

Recommended Texts:
1. *Statistical Decision Theory and Bayesian Analysis*, J.O. Berger (1985)
2. *Bayes and Empirical Bayes methods for Data analysis*, B.P. Carlin and T.A. Louis (1996)

ST309 Non-Parametric & Categorical Data Analysis (3 Credits)
Prerequisites: ST203
Non-Parametrics : One sample sign test, Binomial test, Two sample sign test, Wilcoxon paired samples, Signed rank test, Wilcoxon and Mann Whitney test, Correlation tests, Tests of independence, Wald- Wolfowitz runs test, Kruskal-Wallis test, Friedman test.
Categorical Data Analysis : Multinomial distribution and Goodness of fit tests, The Kolmogorov-Smirnov test, Inference on two-dimensional contingency tables, Models for binary response variables and generalized linear models: Logistic regression, logit models, probit models, Model diagnostics

Log-linear models: Log-linear models for two or more dimensions, testing goodness of fit, estimation model parameters, Strategies in model selection, Analysis of deviance, Log-linear models for ordinal variables,
Some practical assignments will be given for this course

Recommended Texts:
1. Nonparametric Statistical Inference, Gibbons J.D. & Chakrabortic S.,
2. Categorical Data Analysis, Alan Agresti
3. Generalised Linear Models, McCullagh and Nelder

ST 325/MT 325 Seminar (1 credit)
(Prerequisies: ST 306, ST 307)
A student is expected to carry out an extensive literature survey on a topic assigned to him/her by a senior staff member. At the completion of the course the student is expected to write a report of not less than ten pages, and make a presentation.

CS 315 Design and Analysis of Algorithms (2 Credits)
(Prerequisites: CS 201, CS 202)
Analysis of algorithms: time complexity, big O notation. Sorting algorithms: bubble sort, selection sort, insertion sort, quick sort, heap sort, merge sort and external sorting methods. Hashing: hash functions and collision resolution: separate chaining, linear probing and double hashing. Classification of Algorithms by Implementation and Design Paradigm: Divide & Conquer Algorithms, Dynamic Programming, Greedy Algorithms, Recursive Algorithms, Backtracking, Alfa-Beta pruning, Branch & Bound Search; Analysis of Algorithms, NP- completeness; Classification by Field of Study: Searching, Sorting, String matching, Graph, Machine Learning; Genetic algorithms

Recommended Texts:
1. Sara Baase, Allen Van Gelder (2000), *Computer Algorithms - Introduction to Design & Analysis*, Addison-Wesley
2. Thomas H. Cormen, Charles E. Leiserson & Ronald L. Rivest (2000), *Introduction to Algorithms*, McGraw-Hill

MT 304 Partial Differential Equations (2 credits)
(Prerequisite: MT 103)
First order partial differential equations: Linear equations, Non-linear equations, Characteristics.
Second order partial differential equations: Equations with constant coefficients, Equations with variable coefficients, Laplace equation, Wave equation, Diffusion equation, Boundary value problems,
Use of Fourier series.
Numerical methods of solving partial differential equations.
Recommended Texts:

1. R. V. Churchill & J.W. Brown (1987), *Fourier Series and Boundary Value Problems*, McGraw-Hill
2. E.T. Copson (1975) *Partial Differential Equations*, Cambridge University Press

MT 313 Convex Analysis (2 credits)
(Prerequisite: MT 202)
Convex sets, Convex functions, Continuity and Differentiability of convex functions, Minimum and maximum of a Convex function over a Convex set, Lagrange multipliers, Minimax theorems and duality, Saddle-functions

Recommended Text:

1. *Convex Analysis*, R. Tyrell Rockafellar.(1987)

MT 314 Network Optimization Theory (3 credits)
(Prerequisite: MT 210)
Introduction, Paths, Trees and Cycles, Shortest Paths, Maximum flows, The Traveling Salesman problem.

Recommended Text:

1. *Linear programming and Network Flows*, Mokhtar S. Bazaraa. (1997)

MT 315 Operations Research III (2 credits)
(Prerequisites: MT 109, MT 314)
Simulation, Network Scheduling, Information Theory.

Recommended Text:

1. *Operations Research*, Kanti Swarup. (1982)

MT 316 Non-Linear Programming (3 credits)
(Prerequisite: MT 210)
Quadratic programming, Dynamic programming, Geometric programming, Probabilistic programming, Fractional programming, Gradient Search methods.

Recommended Text:

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