ANNEXURE-III

M.Sc. (Applied Statistics and Informatics)

STRUCTURE of the Course

This is a two-year postgraduate course consisting of four semesters. Each semester consists five theory papers and one practical/ project. In semester III and IV there are three elective papers. One elective paper has to be selected from E-I, E-II, E-III for semester-III and from E-IV, E-V, E-VI for semester IV.

Equivalence: This course is equivalent to M. Sc.(Statistics) course since it covers more than 75% of the core papers of M.Sc.(Statistics) course of Shivaji University.

Notations: A Seven /Nine-character code is given to each head. In MASI "M" stands for M.Sc. and "ASI" stands for Applied Statistics and Informatics. The first digit following MASI is Semester Number. The second digit "0" stands for the compulsory theory paper, the digit "1" stands for a practical paper, the digit "2" stands for an elective paper, and the digit "3" stands for an project work. The third digit indicated the serial number of Paper/Practical no. / Elective paper no/ project no. in that semester. For elective paper, fourth number indicates elective groups and next indicates serial number in that group. For example MSAI-203 is third compulsory paper of second semester while MSAI-32423 is fourth paper of the third semester which is an elective course and it is the third course in the second elective group.

Semester -I		**Semester –II**	
Paper Number	**Title of the Paper**	**Paper Number**	**Title of the Paper**
MASI -101	Fundamentals of Computer Programming	**MASI -201**	Probability Theory
MASI-102	Statistical Mathematics	**MASI -202**	Multivariate Analysis
MASI-103	Probability Distributions	**MASI -203**	Sampling Theory
MASI-104	Statistical Inference	**MASI -204**	Linear Models and Design of Experiments
MASI-105	Statistical Computing and Numerical Methods.	**MASI -205**	Advanced Data Structure with C++
MASI- 116	Practical -I	**MASI- 216**	Practical -II and Project-I

Semester -III		Semester-IV	
Paper Number	**Title of the Paper**	**Paper Number**	**Title of the Paper**
MASI-301	Stochastic Processes	**MASI-401**	Optimization Techniques
MASI-302	Computer Graphics	**MASI-402**	Discrete Data Analysis
MASI-	Elective I	**MASI-**	Elective IV
MASI-	Elective II	**MASI-**	Elective V
MASI-	Elective III	**MASI-**	Elective VI
MASI-336	Practical- III	**MASI-436**	Practical -IV and Project- II

Elective I MASI-32311 Regression Analysis
MASI-32312 Computer Intensive Statistical Methods

Elective II MASI-32421 Advanced Programming
MASI-32422 Data Base Managment System

Elective III MASI-32531 Reliability and Survival Analysis
MASI-32532 Analysis of Clinical Data
MASI-32533 Actuarial Statistics

Elective IV MASI-42341 Time Series Analysis
MASI-42342 Planning and Analysis of Industrial Experiments

Elective V MASI-42451 Industrial Statistics
MASI-42452 Statistical Decision Theory

Elective VI MASI-42561 Data Warehousing and Data Mining
MASI-42562 Artificial Intelligence

Credits : i) Each theory paper has 4 credits. Practical-I and Practical-III have 4 credits each, while Practical-II,Practical-IV, Project Work-I and Project Work-II will have 2 credits each. Total credits of the course are 96.
ii)Students persuing M.Sc. (ASI) course can take additional paper from M.Sc.(Statistics) course as add on papers,

Admission Criteria:

Students qualifying B.Sc. (Statistics) with B+ or equivalent grade are eligible for the admission to the course. It will be based on entrance test.

Examination Pattern:

There shall be continuous internal evaluation scheme for which internal examinations will be for 20 marks, while University examination will be for 80 marks. Internal examination will be based on midterm test (10 marks), seminar (5 marks) and viva (5 marks).

1. Nature of the theory question papers:

a) There shall be 8 questions each carrying 16 marks.
b) Question No.1 is compulsory and shall contain 10 short sub-questions each carrying 2 marks. Students have to attempt any 8 sub-questions.
c) Students have to attempt any 4 questions from question No. 2 to 7.
d) Question No. 2 to 6 shall contain 2 to 4 sub-questions.
e) Question No. 7 will be short note type. Students are expected to solve any 4 out of 6, each carrying 4 marks.

2. Practical Paper:

Practical MASI - 116 and MASI - 316.

i. There shall be two practical examinations. The first examination will be taken as a mid-term test and the second will be at the end of the term. Average of the marks obtained in the two examinations will be considered for reporting.
ii. Each practical examination will be for 60 marks, containing 8 questions for 12 marks each. Students are expected to attempt any FIVE.
iii. 20 marks are reserved for day to day practical work and journal.
iv. 20 marks are for practical viva.

Practical MASI- 216 and MASI - 416

i. There shall be two practical examinations. The first examination will be taken as a mid-term test and the second will be at the end of the term.
ii. Each practical examination will be for 60 marks, containing 8 questions for 12 marks each. Students are expected to attempt any FIVE.
iii. Marks obtained in the two examinations will be converted to 30.
iv. 10 marks are reserved for day to day practical work and journal.
v. 10 marks are for practical viva.

Project work-I and Project work-II

i) Project work carries 50 marks. Students are expected to undertake a project preferably by visiting relevant industrial organization. They should spend at least two weeks in the industry. During their visit to the industry they are expected to undertake problem of mutual interest and provide at least partial solution to it. Project work consists of understanding the domain of the problem, formulation of the problem, collection of the relevant data, Analysis of the data and report writing. They are expected to use software for which they are trained.
ii) The project report will be evaluated for 25 marks and viva on the project work will be for 25 marks. This evaluation will be done internally.

Fees

6000 per annum (Tuition fee) + other fees (As per university rules).

MASI 101: FUNDAMENTALS OF COMPUTER PROGRAMMMING

1. Algorithm Development: Problem redefinition, writing step by step procedure, representation in terms of Flow chart/Decision Trees, Tracing, Testing. Sequential flow of Logic, Control structures, Iterative method to reach the solution.
2. Solutions to the simple problems: Pseudo code generation, variables, constants and their data types, Implementation of sequential, selection and iterative structures.
3. Coding: Syntax and semantics, documentation and debugging of a program, Device (Files) interfacing.
4. Solutions to the complex problems: Structured programming, Modular programming, TOP DOWN/BOTTAM UP approach, Recursive algorithms, Examples, Illustrating structured program development methodology and use of block structured algorithmic language to solve specific problem.
5. Advanced Data Types and their implementation: Arrays, Records, Pointers, Applications in the record keeping of real life system.
6. Searching, Sorting and Update of the data : Various methods, Design and Analysis of algorithms - Devide and conqure, Backtracking,
7. Introduction to ADTs: List, Stacks, Queues, Linked Lists, Choice of the data structure and efficiency issues. Emphasis should be given on better programming styles and implementation is expected through C compiler.

Reference:

1. D. Ravichandran: Programming with C++ (MGH)
2. Dromey: How to solve it by computer,(PHI-85).
3. Horowitz & Sahani: Fundamentals of Computer Algorithms,(Galgotia-95).
4. Knuth: Fundamental algorithms,(Narosa-85).
5. Knuth: Art of Computer Programming,(Addison Weisley-70-80)
6. Kruse: Data structures and program design (PHI)
7. Wilf: Algorithms and complexity (PHI)
8. N.Wirth: Algorithms + Data structures = Program,(PHI).
9. Wirth: Algorithms and data structures (PHI)
10. Schneider,Weingart and Perriman: Introduction to problem solving and problem solving attitude, (Wiley Easteren-82).

MASI 102: STATISTICAL MATHEMATICS

1. Set of real numbers, countable and uncountable sets, countability of rationals and uncountability of the interval (0,1) Supremum and Infimum of bounded sets, limit point of a set, open, closed, dense and compact sets. Bolzano-Weierstrass and Heine-Borel Theorems (Statements only). Applications of these theorems.
2. Sequence of real numbers, convergence, divergence. Cauchy sequence. Convergence of bounded monotone sequence. Limit inferior and limit superior of the sequences.
3. Series of numbers, tests for convergence (without proof) test for absolute convergence, convergence of sequences of non-negative terms.

4. Vector space, subspace, linear dependence and independence, basis, dimension of a vector space, example of vector spaces.
5. Null space, Special types of matrices: elementary operations, rank of a matrix. Orthonormal basis and orthogonal projection of a vector. Gram-Schmidt orthogonalisation, Kronekar product. Idempotent matrices, inverse of a matrix, their simple properties, Partitioned Matrices, Orthogonal matrices.
6. Characteristic roots of a matrix, algebraic and geometric multiplicities, characteristic vectors and their orthogonal property. Caley-Hamilton Theorem and applications.

References:

1. Malik S. C. & Arora S.(1991) : Mathematical Analysis- Wiley Eastern Limited IInd edition.
2. Goldberg R. R. (1964): Methods of Real Analysis- Blaisdell Publishing company, New york, U.S.A.
3. Bartle G. R. (1976): Element of Real Analysis- Wiley 2nd edition.
4. Bartle G.R. & Sherbert D. R. (2000): Introduction to Real Analysis- John Wiley & Son Inc.
5. Royden (1988): Principles of Real Analysis - Macmillian.
6. Widder (1989): Advanced Calculus - Dover Publication.
7. Apostol (1985): Mathematical Analysis - Narosa Publishing House, T.M.
8. Rao A. R. & Bhimashankaram P. (1992) : Linear Algebra. Tata Mc-Graw Hill, NewDelhi
9. Hadely G (1987): Linear Algebra - Narosa Publishing House.
10. Rao C. R. (1973): Linear Statistical Inference and Its Applications, Second Edition Wiley Eastern.
11. Searl S. B.(1982) : Matrix Algebra Useful for Statistics – Wiley.
12. Graybill , F.A (1961) : An introduction to linear Statistical models Vol-I- McGraw-Hill Book company Inc.

MASI 103: PROBABILITY DISTRIBUTIONS

1. Brief review of basic distribution theory. Distribution function and its properties, Relation of distribution function with uniform distribution. Decomposition of distribution function into discrete and continuous parts.
2. Functions of random variables, their distribution in case of univariate random variables and its applications.
3. Expectation and moments, probability generating function, moment generating function, convolution and examples.
4. Moment inequalities:- Markov, Chebychev, Holder, Minkowski and Jensen inequalities with their applications. Basic inequality Liapunov's.
5. Bivariate discrete and continuous distributions, marginal distributions. Examples of many joint with given marginal distributions. Independence, conditional, distributions and examples. Distribution of function of bivariate random variables using Jacobian of transformation.
6. Multinomial distribution, Bivariate Poisson, Bivariate exponential and Bivariate normal distribution and their properties. Dirichilet distribution.

7. Symmetric distributions, properties of symmetric distributions, non-regular families, location and scale families and examples.
8. Order Statistics- distribution of ith order statistic, joint distribution of (i,j)th order statistics,independence of exponential spacing & examples

References:

1. Rohatagi V. K.& Saleh A. K. Md. E.(2001) : Introduction to Probability Theory and Mathematical Statistics- John Wiley and sons Inc.
2. Johnson N. L. & Kotz. S. (1996): Distributions in Statistics Vol-I, II and III- John Wiley and Sons New york.
3. Johnson N. L. & S. Kotz. John: Multivariate Distributions - Wiley and sons New york.
4. Casella & Berger (2002): Statistical Inference - Duxbury advanced series. IInd Edition.

MASI 104: STATISTICAL INFERENCE

1. Sufficiency principle, factorization theorem, minimal sufficiency, minimal sufficient partition, construction of minimal sufficient statistics, minimal sufficient statistic for exponential family, power series distribution and non regular families.
2. Completeness, bounded completeness, ancillary statistics, Basu's theorem and applications.
3. Problem of point estimation, unbiased estimators, minimum variance unbiased estimator, Rao- Blackwell theorem and Lehmann-Scheffe theorem and their uses. Necessary and sufficient condition for MVUE and their applications.
4. Method of maximum likelihood (MLE) and small sample properties of MLE, method of scoring and application to estimation in multinomial distribution.
5. Problem of testing of Hypothesis: Simple and composite hypotheses. Randomized and non-randomized tests. Most powerful test, Neyman-Pearson Lemma and its applications. Determination of minimum sample size to achieve the desired strengths.
6. Composite hypotheses: Monotone likelihood ratio property, power function of a test, existence of UMP. Tests for one-sided alternatives. UNP tests for two sided alternatives Examples. Their existence and non-existence.
7. Likelihood ratio test. Application to standard distribution, application to contingency table.

References:

1. Rohatgi V.K.(1976): Introduction to Probability Theory & Mathematical Statistics - John Wiley & sons.
2. Lehmann E. L. (1983): Theory of Point Estimation - John Wiley & sons.
3. Rao C. R.(1973): Linear Statistical Inference & its Applications, 2nd Ed wiley.
4. Kale B.K. (2005): First Course on Parametric Inference, A , 2nd Edition. Narosa Publishing House.
5. George Casella, Roger L. Berger (2001) : Statistical Inference (second edition) Duxbury press
6. Dudewicz E.J. & Mishra S. N. (1988): Modern Mathematical Statistics. Wiley Seris in Prob., Stat. John. Wiley & Sons. New York. International students edition.
7. Lehman E. L. (1987): Theory of testing of hypotheses. Students Edition.
8. Ferguson T.S. (1967): mathematical Statistics. A decision theoretical approach Academic press.

9. Zacks S. (1971): Theory of Statistical Inference John Wiley and Sons. New York.

MSAI 105: STATISTICAL COMPUTING AND NUMERICAL METHODS

1. Concept of random number generator, congruential method of generating uniform Variate. Concept of simulation: Generation of Binomial, Poisson, Geometric, Negative Binomial & Multinomial variate. Proofs of related results.
2. Generation of continuous random variables covering Exponential, Normal, Gamma, Chi-square, Bivariate exponential, Bivariate Normal distributions, and mixture of distributions.
3. Excel Introduction to MSEXCEL and exercises on using EXCEL for Statistical analysis covering frequency distribution, histograms, t-test, and test for Independence in 2x2 contingency tables.
4. R – Language. : Introduction to R, elementary programming, application to data analysis
5. Solution to a nonlinear equation: Biscetion method, Newton-Raphson method.
6. Iterative methods: Jacobi, Gauss-Seidel methods with convergence analysis,
7. Numerical Integration: integration by interpolation, adaptive quadratures and Gauss methods

References

1. Morgan B. J. T.(1984): Elements of Simulation. Chapman and Hall.
2. Kennedy William J.,Jr. James E. Gentle. (1980): Statistical Computing Marcel Dekker, Inc. New York and Basel.
3. Christion P. Robert, George Casella (1999): Monte Carlo Statistical Methods, Springer-Verlag, New York, Inc.
4. Luc Devroye (1986): Non- Uniform Random Variate Generation; Springer-Verlag New York Berlin-Heidelberg Tokyo.
5. Rubinstein, R. Y. (1998): Modern Simulation and Modeling (Wiley Series in Probability and Statistics).
6. K.E. Atkinson (1989): An Introduction to Numerical Analysis, Wiley, 1989.
7. K. Eriksson, D. Estep P. Hansbo and C. Johnson (1996): Computational Differential Equations, Cambridge Univ. Press, Cambridge.
8. G.H. Golub and J.M. Ortega (1992): Scientific Computing and Differential Equations: An Introduction to Numerical Methods, Academic Press.
9. J. Stoer and R. Bulirsch (1993): Introduction to Numerical Analysis, 2nd ed., Texts in Applied Mathematics, Vol. 12, Springer Verlag, New York.

MASI 201: PROBABILITY THEORY

1. Classes of sets: Sequence of sets: limsup, liminf and limit of sequence of sets field, σ-field, σ-field generated by a class, Borel σ-field.
2. Probability measure, Probability space, properties of probability measure – continuity, mixture of probability measures. Lebesgue and Lebesgue - Steltjes measures on R. Independence of events.
3. Measurable function, random variable, distribution function of a random variable, simple random variable, elementary random variable liminf, limsup and limit of sequence of

random variables. Method of obtaining a random variable as a limit of sequence of simple random variables.

4. Integration of a measurable function with respect to a measure, expectation of a random variable, monotone convergence theorem, Fatous Lemma, Dominated Convergence theorem and their application.
5. Convergence of sequence of random variables, Almost sure convergence, a characterizing property convergence in probability, uniqueness of limit, a characterizing property. Yule Slutsky results and preservation under continuos transform.(Statements only), convergence in r^{th} mean, interrelationships.
6. Independence: Borel - Cantelli Lemma, Characteristic function simple properties. Inversion theorem and uniqueness property (Statement only).
7. Convergence in distribution, continuity theorem (Statement only), Weak and Strong laws of large numbers, Kolmogorov's three series theorem for almost sure convergence(Statement only), Liaponove's, Lindeberg-Feller Theorems on CLT (Statement only). Applications of the above results.

References:

1. Bhat B. R.(1981): Modern Probability Theory –IIIrd edition :New age international (P)limited,
2. Alan Karr,(1993): Probability Theory – Springer Verlag.
3. Billingsley P.(1986): Probability & Measure –John Wiley and sons

MASI 202: MULTIVARIATE ANALYSIS

1. Multivariate normal distribution, two definitions and their equivalence, singular and nonsingular normal distribution, characteristic function, moments, marginal and conditional distributions.
2. Maximum likelihood estimators of the parameters of the multivariate normal distribution and their sampling distributions.
3. Wishart matrix and its distribution of properties of Wishart distribution, distribution of generalized variance.
4. Hotelling's T^2 Statistic and its distribution. Applications of T^2 statistics and its relationship with Mahalanobis' D2 statistic. Confidence region for the mean vector.
5. Discrimination and classification. Fisher's discriminant function and likelihood ratio procedure, minimum ECM rule, Rao's U statistics and its use in tests associated with discriminant function, classification with three populations.
6. Principal components. Dimension reductions, Canonical Correlation and canonical variables.
7. Introduction to factor analysis, Cluster analysis, Heirarchical and non-Heirarchical clustering. Single, Complete, average linkage method and K-means clustering.

Reference:-

1. Kshirsagar A. M.(1972): Multivariate Analysis. Marcel-Dekker.
2. 2. Johnosn, R.A. and Wichern . D.W (2002): Applied multivariate Analysis. 5th Ad. Prentice Hall.

3. 3. Anderson T. W. (1984): An introduction to Multivariate statistical Analysis 2nd Ed. John Wiely.
4. 4. Morrison D.F. (1976): Multivariate Statistical Methods McGraw-Hill.

MASI 203: SAMPLING THEORY

1. Concept of population and sample, Need for Sampling, census & sample surveys, basic concepts in sampling and designing of large-scale surveys design, sampling scheme and sampling strategy. Basic methods of sample selection: SRSWR, SRSWOR.
2. Stratification, Allocation and estimation problems. Construction of Strata: deep stratification, method of collapsed strata.
3. Systematic sampling: The sample mean and its variance, comparison of systematic with random sampling, comparison of systematic sampling with stratified sampling, comparison of systematic with simple and stratified random sampling for certain specified population. Estimation of variance, Two stage sample: Equal first stage units, Two stage sample: Unequal first stage units; systematic sampling of second stage units.
4. PPSWR methods: Cumulative total method, Lahiri's method related estimation Problems and PPSWOR methods and related estimation of a finite population mean (Horwitz- Thompson and Des Raj estimators for a general sample size and Murthy's estimator for a sample of size 2), Midzuno sampling.
5. Use of supplementary information for estimation: ratio and regression estimators and their properties. Unbiased and almost unbiased ratio type estimators, Double sampling.
6. Cluster sampling. Two – stage sampling with equal number of second stage units.
7. Non - sampling errors: Response and non- response errors. Hansen – Horwitz and Demig's techniques.

References

1. Sukhatme P. V., Sukhatme S. & Ashok C : Sampling Theory of Surveys and Applications – Piyush publications
2. Des Raj and Chandhok. P. (1998): Sample Survey Theory - Narosa publication.
3. William G. Cochran. (1977): Sampling Techniques- IIIrd edition –John and Wieley sons Inc.
4. Parimal Mukhopadhyay (1998): Theory and Methods of Survey Sampling -Prentice Hall of India private limited.
5. Murthy M.N. (1977): Sampling Theory of Methods - Statistical Publishing Society, Calcutta.

MST 204: LINEAR MODELS AND DESIGN OF EXPERIMENTS

1. General linear model: definition, assumptions, concept of estimability, least squares estimation, BLUE, error space, estimation space, Guass Markov theorem, variances and covariances of BLUEs.
2. Distribution of quadratic forms for normal variables: related theorems (without proof). Tests of hypothesis in general linear models.
3. Analysis of variance : one way classification, two way classification without interaction and with interaction with equal number of observations per cell. Estimation and related tests of hypothesis, Tukey's test of additivity.

4. Multiple comparisons: Three types of errors, Tukey , Sheffe and Bonferroni producer.
5. Analysis of Covariance: estimation of parameters, related tests of hypothesis. General theory and application of one way and two way set up.
6. General block design: Two way classification with unequal number of observations per cell (without interaction), connectedness, balancedness , orthogonality, related tests of hypothesis.
7. BIBD: Definition, parametric relationship, Inter and Intra Block analysis, Symmetric BIBD.

References:

1. Kshirsagar A. M. (1983): Course in Linear Models,Marcel dekker.
2. Joshi D. D. (1987): Linear Estimation and Analysis of Experiments, Wiley Estern Ltd.
3. Giri N. S. & Das M. N. (1979): Design and Analysis of Experiments, Wiley Estern Ltd.
4. Searle S. R. (1971): Linear Models, John Wiley & Sons. New York.
5. Chakravarti . M. C. (1962): Mathematics of Design of Experiments, Asia Publishing House, Bombay

MASI- 205: ADVANCED DATA STRUCTURE WITH C++

1. Overview of Oops concepts, Programming in C++: Concept of OOP, Data types, Variables, Statements, Expressions, Control structures, Looping, Functions, Pointers.
2. Stack, Applications of Stack, Queue, Priority Queue, circular queue Applications of queue, Linked lists, doubly linked list, circular list, dynamic memory allocation, implementation of linked list, further operations, implementation of sparse matrices.
3. Binary tree, binary search tree, representation, traversal, insertion, deletion, application Binary trees, threaded binary trees. General trees, using binary trees to represent general trees, Huffman tree, AVL tree
4. Graphs, representation, Depth first search traversal, Breadth first search traversal, minimum spanning tree, shortest path algorithm, topological ordering. Bubble sort, insertion sort, selection sort, hell sort, Heap sort, Merge sort, Quick sort, Radix sort.
5. Searching, Sequential binary tree searches, ternary trees, Hashing, collision processing, B-tree indexing, Design and analysis of algorithms: Dynamic programming, Greedy algorithm, Divide and conquer, Backtracking

References:

1. D. Samantha: Classic Data Structures, PHI.
2. Kruse, Leung, Tondo: Data Structure and Program Design in C (PHI).
3. Sartaj Sahani: Data Structure Algorithms and Applications in C++ Macgraw Hill.
4. Mark Allan Welss: Data Structure and Algorithm analysis in C++ Addison weslay.
5. Decker, R and Hirshfield, S. (1998): The Object Concept: An Introduction to Computer Programming using C++. (PWS Publishing).
6. Lippmann, S.B. and Lajoie, J. (1998): C++ Primer. Third edition. (Addison-Wesley).
7. Naughton, P. (1996): The Java Handbook. (Tata McGraw-Hill).
8. Savitch, W.J. (2001): Problem Solving with C++: The Object of Programming. Third edition. (Addison-Wesley Longman).

MASI 301: STOCHASTIC PROCESSES.

1. Definition of stochastic process, classification of stochastic processes according to state space and time domain. Finite dimensional distributions. Examples of various stochastic processes.
2: Definition of Markov chain. Examples of Markov chains, Formulation of Markov chain models initial distribution transition probability matrix, Chapman-Kolmogorov equation. calculation of n-step transition probabilities.
3. Classification of states, irreducible Markov chain, period of the state, random walk & gambler's ruin problem. First Entrance Theorem, First passage time distribution.
4. Long-run distributions of Markov chain, relation with mean recurrence time, stationary distribution.
5. Discrete state space continuous time Markov chain. Poisson process & related results. Birth and death processes and associated cases. M/M/1, M/M/S queuing models and related properties.
6. Renewal and delayed renewal processes, related theorems, key renewal theorem (without proof) and its application.
7. Galton-Watson Binaymi Branching process. probability of ultimate extinction. Distribution of population size, and association results.
8. Simulation of Markov Chain, Poisson process and branching process. (Algorithms)

References

1. Medhi J. (1982): Stochastic Process, Wiley Eastern.
2. Parzen E. (1962): Stochastic Process, Holden-Pay.
3. Karlin & Taylor: A First Course in Stochastic Process, Vol. -1, Academic Press.
4. Cinlar E.: Introduction to Stochastic Process, Prentice Hall.
5. Srinivas and Mehta (1976): Stochastic Processes, TATA McGraw -Hill, Publishing Conpany limited New Delhi.

MSAI 302 COMPUTER GRAPHICS

1. Introduction:a) Input/output devices : Keyboard, Mouse, Trackball, Joysticks, Data Glove,Digitizers, Light pen, Touch panels, Image scanners, Printers and plotters.b) Logical Input Devices : Locator, Stroke, String, Valuator, Choice and Pick.c) Video Display Devices : Refresh Cathode-Ray Tubes, Raster-Scan Displays,Random-Scan Displays, Color CRT Monitors, Direct-View Storage Tubes, FlatPanel Displays d) Raster-Scan Systems: Video Controller, Raster-Scan DisplayProcessor, Random-Scan Systems.
2. Output Primitives:a) Line, Circle, Ellipse and Curve generation algorithm, b) Polygon filling algorithm c) Windowing and clipping : Window to Viewport transformation, line clipping and polygon clipping, B) 2D and 3D transformations : a) 2D basic transformation, other transformation, composite transformation, matrix representation and homogeneous transformation, b) 3D concepts : Display models, parallel and

perspective projections c) 3D basic transformation, other transformation & composite transformation.

3. Colors in computer graphics: Chromatic and achromatic light, properties of light, color lookup tables,Color models : XYZ, RGB, CMY, HSV, HLS, B) Curve generation: a) Beziercurve, properties of Bezier curve, Cubic Bezier Curve, b) B-Spline curves : i)Uniform, Periodic B Spline, ii) Cubic, periodic B-spline, iii) Open, uniform B- Spline iv)Non-uniform B-spline, c) Beta-Spline : Beta spline continuity conditions, cubic periodicbeta spline, matrix Representation, d) Introduction to fractal (Koch and Hilberts curve)
4. Illumination model and shading methods:a) Basic illumination models : Ambient light, diffuse reflection, specular reflection and its Phong model, shadows and transparency, ray tracing, displaying continuous tone images, halftone pattern and Dithering techniques, aliasing and antialiasing b)Phong rendering methods: Constant intensity shading, Gouroud shading, Phong and Fast Phong shading B) Visible surface detection methods :Classification of visible surface detection algorithm, Back-face detection, depth-buffer method, A-buffer method and Painter's algorithm C) Design and implementation of Application s/w :Study of advance software platform viz. 3-D studio max, Animator Pro, Introduction to OPEN GL, comparison with the facilities provided by conventional IDEs viz. CC++, Visual computing environment.

Reference

1. Donald Heran and M Pauline Baker: Computer Graphics
2. Roger Stevens: Advanced Graphics Programming in C and C++ 3) F. S. Hill: Computer Graphics
3. Newmann Sproul: Principles of Interactive Computer Graphics
4. Foley J D & van Dam: Fundamentals of Interactive Computer Graphics
5. Plastock & Kelly: Theory and Problems of Computer Graphics
6. Devid rogers: Mathematical Elements of Computer Graphics
7. David rogers: Procedural Elements of Computer Graphics
8. Steven Harrington: Computer Graphics: A Programming Approach
9. S P Bhandari and S A Joshi: Computer Graphics

MASI 401: OPTIMIZATION TECHNIQUES

1. Linear programming problem (LPP): Theorems related to the development of Simplex algorithm, Proof of the theorems related to a basic feasible solution (b.f.s); Reduction of a f.s. to a b.f.s., Improvement of a b.f.s., Existence of unbounded solution, Optimality conditions. For other related theorems, statements only.
2. Artificial variable technique; two phase and Big M method, the case of redundancy. Revised simplex method.
3. Concept of Duality, theorems related to duality, complementary slackness property and development of dual simplex algorithm.
4. Sensitivity Analysis: Changes in the cost vector, requirement vector and non basic activity vector; addition of new variables and addition of new constraints.
5. Theory of games: two person zero sum games, minimax and maximin principles, Saddle point, mixed strategies; rules of dominance, solution of 2 x 2 game by algebraic method,

Graphical method, Reduction of the game problem as LPP, Minimax and maximin theorem (without proof).

6. Integer Linear Programming Problem (ILPP): The concept of cutting plane, Gomory's method of cutting plane for all ILPP and mixed ILLP, Branch and Bound method.
7. Quadratic programming: Kuhn-Tucker conditions of optimality, methods due to Beale, Wofle.

References:

1. Hadley G.(1969): Linear Programming ,Addison Wesley
2. Taha H. A. (1971): Operation Research An Introduction- Macmillan N.Y.
3. Kanti Swaroop & Gupta M. M. (1985): Operations Research, Sultan Chand & Co.
4. J. K. Sharma (2003): Operation Research theory and Applications, IInd Edition Macmillan India ltd.

MASI 402: DISCRETE DATA ANALYSIS

1. Log linear model for two and three dimensional contingency tables: Interpretation of parameters, comparison with ANOVA and regression. ML estimation of parameters, likelihood ratio tests for various hypotheses including independence. Marginal and conditional independence, partial association, models with quantitative levels
2. Generalized linear models: concept of generalized linear model, Link function, ML estimation, large sample tests about parameters, goodness of fit, analysis of deviance, introduction to Poisson regression.
3. Logistic regression : logit model for dichotomous data with single and multiple explanatory variables, ML estimation, large sample tests about parameters,, variable selection, extension to polytomous data
4. Non-parametric regression and Interpolating and smoothing splines for simple regression. Use of cross-validation applications to logistic and Poisson regression.

References:

1. Yvonne M. Bishop, Stephen E. Fienberg, Paul W. Holland Discrete (1975): Multivariate Analysis: Theory and Practice
2. Hosmer D.W. and Lemeshow S. (2000): Applied Logistic Regression, 2nd Ed. Wiley, New York.
3. Agesti A. (1990) : Categorical Data Analysis. Wiley, New York.
4. R.Christensen (1997): Log-Linear Models and Logistic Regression. 2nd Ed. Springer, New York.

Elective-I

MASI 32311: REGRESSION ANALYSIS

1. Multiple regression model, Least squares estimate (LSE), Properties of LSE
2. Hypothesis testing, confidence and prediction intervals. General linear hypothesis testing.
3. Multiple correlation and adjusted multiple correlation coefficient, Null distribution of sample correlation and multiple correlation coefficient. Partial correlation coefficient and its relation with multiple correlation coefficient. Tests for significance of simple,

multiple and partial correlation coefficients. Variable Selection Procedures: Mallows Cp, forward, backward selection methods.
4. Residuals and residual diagnostics. Transformation of Variables: Box-Cox power transformation.
5. Multicollinearity: Consequences, detection and remedies. Autocorrelation: Consequences. Durbin-Watson test, Estimation of parameters in presence of auto-correlation.
6. Dummy variables and their use in regression analysis.
7. Introduction to Nonlinear regression models.

References

1. Draper N.R. and Smith,H. (1998): Applied Regression Analysis, 3rd Ed Wiley
2. Wiesberg, S. (1985): Applied Linear Regression, Wiley.
3. Kutner, Neter, Nachtsheim and Wasserman (2003): Applied Linear Regression Models, 4th Edition, McGraw-Hill
4. Montgomery, D.C., Peck, E.A. and Vining, G.(2001): Introduction to Linear Regression Analysis, 3rd Ed .Wiley
5. Cook, R.D. and Wiesberg, S. (1982): Residuals and Influence in Regression. Chapman and Hall.

MSAI 32312: COMPUTER INTENSIVE STATISTICAL METHODS

1. Bootstrap methods: Re-sampling paradigms, bias and standard errors, Bootstrapping for estimation of sampling distribution, confidence intervals, variance stabilizing transformation, bootstrapping in regression and sampling from finite populations
2. Jackknife and cross-validation: Jackknife in sample surveys, jack-knifing in regression with hetero-scadisticity, cross-validation for tuning parameters.
3. EM algorithm: Applications to missing and incomplete data problems, mixture models. Applications to Bayesian analysis. Monte Carlo EM algorithm MCMC methods in missing data.
4. Smoothing with kernels: Density estimation, simple nonparametric regression. Failure rate. Permutation tests

References:

1. Fishman, G.S. (1996): Monte Carlo: Concepts, Algorithms, and Applications.(Springer).
2. Rubinstein, R.Y. (1981): Simulation and the Monte Carlo Method. (Wiley).
3. Tanner, M.A. (1996): Tools for Statistical Inference, Third edition. (Springer.)
4. Efron, B. and Tibshirani. R.J. (1993): An Introduction to the Bootstrap.
5. Davison, A.C. and Hinkley, D.V. (1997): Bootstrap Methods and Their Applications (Chapman and Hall).
6. Shao J. and Tu, D. (1995): The Jackknife and the Bootstrap. Springer Verlag. McLachlan, G.J. and Krishnan, T. (1997): The EM Algorithms and Extensions.(Wiley.)
7. Simonoff J.S. (1996): Smoothing Methods in Statistics. (Springer).
8. Kennedy W. J. & Gentle J. E. (1980): Statistical Computing (Marcel Dekker)

Elective- II

MASI 32421: ADVANCED PROGRAMING

1. Introduction to .NET, evolution of .NET platform, advantages of working .NET, .NET framework, CLR, Basic of ASP .NET, Unified programming classes, security in .NET Language and web upport {C#, VB, script .NET, web support for .NET, web services] ASP .NET Basics: ASP .NET page structure, directives, code declaration blocks, code render blocks, ASP .NET server controls, server side include directives, HTML tags, view state.
2. VB. Net and C# programming basic: Control event, Variables and variable declaration, Arrays, Functions, Operators, Conditional logic, Loops, namespace, OOP concepts , Objects, Properties, Methods, Classes, Scope, Events, Inheritance, Delegates , Interface.
3. Validation Controls: Client side v/s servers side validation, configuring client side validation, Required field validate, compare validater, Range Validater Range validate, Regular expression validator. Custom validate.
4. Database Design and development: Introduction, creating database for inheritance application, designing tables for intranet application, Relationship mgt., stored procedures, queries, introduction to data grid, data list and data sets.
5. Error Handling: Introduction, Types of error, viewing error information, Handlin errors, .NET debugger.

References

1. Zak Ruvacaba: Build your own ASP .NET website using C# and VB .NET.
2. Mridula Parihar: ASP .NET Bible.

MASI-32422- DATA BASE MANAGEMENT SYSTEM

1. Introduction to DBMS : Concept and architecture of DBMS ,Schemas, instances and data independence, Introduction to conventional data models (Network ,Hierarchical and Relational) Relational model : Concept , Relational Algebra and Tuple and Domain Calculus SQL – basic structure of SQL Queries, set operation, aggregate function ,nested subqueries, Complex queries, Views ,modification of the database. Integrity constraints , Indexing RDBMS - Oracle
2. Database Design and the E-R Model: Overview of the design process, E-R Model, constraints, E-R diagrams, E-R design Issues Relational database design : Functional dependencies , Normal Forms , Loss less join and Dependencies preserving decomposition
3. Transactions and Concurrency Control: - Transaction concept, transaction state, concurrent execution, serializability, Recoverability, Locking, Time stamp ordering, Multiple Granularity of data items. Recovery System :- Failure classification, storage structure, recovery and atomicity, log-based recovery Security and protection : Role of DBA , File structure , table space , segments , User database, Data dictionary management , memory structure , process structure .
4. Developing application software: Using Oracle products, SQL, PL/SQL Advance techniques in databases: History of ODBMS, Concept of persistence, problems posed by persistent objects, RDBMS to solve persistent objects, designing object database, concept of ODBC, Introduction to parallel, distributed databases.

References:

1. Korth and Silderschutz: Database systems concepts (TMH)
2. C.J.Date : Introduction to database systems (Narosa)
3. Desai B: Introduction to database concepts (Galgotia)
4. Ulman J.D. : Principles of database systems (Galgotia)
5. Oracle installation and user manual
6. Raghu Ramakrishna: Database management system

Elective- III

MASI-32531- REALIBILITY AND SURVIVAL ANALYSIS

1. Structure function, dual of a structure, cuts and paths, Modular decomposition, bounds on system reliability. Associated random variables. Reliability concepts and measures, components & systems, coherent systems, reliability of coherent systems.
2. Life time distributions, survival functions, hazard rate, cumulative hazard function, residual life time, survival function of residual life time, mean residual life time, one-one correspondence of these functions. Computation of these function for Common life time distributions: exponential Weibull, Gamma, Makeham, Pareto, Rayleigh, log-normal etc: computation of survival and failure rate function proportional hazard models and proportional hazard model.
3. Notions of aging: IFR,IFRA,DMRL, NBU,NBUE classes and their duals , aging properties of common life time distributions, closure Properties under formation of coherent structures, convolutions and mixtures of these classes.
4. Concept of censoring, various types of censoring, Estimation and Testing of parameters of exponential distribution under various types of censoring.
5. Estimation of survival function: Actuarial Estimator, Kaplan Meir product limit estimator, properties: self-consistency and MLE.
6. Tests for exponentiality against alternatives IFRA, NBU and NBUE.
7. Two-sample problem: Gehen test, Log rank test, Mantel Haenszel test.
8. Semi parametric regression for failure rate – Cox's proportional hazards model. Related estimation and test procedures.

References :

1. Barlow R.E. and Proschan F. (1975): Statistcal Theory of Relibilty & Life Testing, Holt, Reinhart and Winston.
2. Lawless J.F.(1982) : Statistical Models & Methods of Life Time Data, John Wiley.
3. Miller R.C. (1981) : Survival Analysis. John Wiley
4. Bain L.J (1978) : Statistical Analysis of Reliability & Life testing , Models, Marcel Dekker.
5. Martz H.F. and Waller R.A (1982): Bayesian Reliability Analysis, John Wiley.
6. Nelson W. (1982): Applied Life Data Analysis, Jhon Wiley and Sons Inc.
7. Deshpande, Purohit: Life time data: statistical models and methods, World Scientific, 2005.

MASI-32532 ANALYSIS OF CLINICAL DATA

1. Introduction to clinical trials and other types of clinical research, bias and random error in clinical studies, overview of Phase I-IV trials, multi-center trials; randomized, controlled clinical trials; concept of blinding/masking in clinical trials.
2. Design of Phase 1-3 clinical trials: parallel vs. cross-over designs, cross-sectional vs. longitudinal designs, review of factorial designs, objectives and endpoints of clinical trials, formulation of appropriate hypotheses (equivalence, non-inferiority, etc.); sample size calculation; design for bioequivalence/ bioavailability trials, sequential stopping in clinical trials.
3. Analysis of Phase 1-3 trials: Use of generalized linear models; analysis of categorical outcomes, Bayesian and non-parametric methods; analysis of survival data from clinical trials
4. Epidemiological studies: case-control and cohort designs; odds ratio and relative risk; logistic and multiple regression models.

References:

1. S.C. Chow and J.P. Liu (1998): Design and Analysis of Clinical Trials - Concepts & Methodologies, John Wiley & Sons, NY.
2. S.C. Chow and J.P. Liu (2000): Design and Analysis of Bioavailability & Bioequivalence Studies, Marcel Dekker.
3. W.W. Daniel, Biostatistics (2002): A Foundation for Analysis in the Health Sciences (6th ed.), John Wiley, NewYork.
4. J.L. Fleiss (1986): The Design and Analysis of Clinical Experiments, John Wiley & Sons,.
5. D.W. Hosmer and S. Lemeshow (1989): Applied Logistic Regression, John Wiley and Sons, NY,
6. E. Vittinghoff, D.V. Glidden, S.C. Shiboski and C.E. McCulloch (2005): Regression Methods in Biostatistics, Springer Verlag,.
7. J.G. Ibrahim, M-H Chen and D. Sinha (2001): Bayesian survival analysis, Springer, NY.

MASI-32533 ACTURIAL STATISTICS

1. Basic concepts and Life Tables: Utility theory, insurance and utility theory, models for individual claims and their sums, survival function, curtate future lifetime, force of mortality. Life table and its relation with survival function, examples, assumptions for fractional ages, some analytical laws of mortality, select and ultimate tables. Multiple life functions, joint life and last survivor status, insurance and annuity benefits through multiple life functions evaluation for special mortality laws.
2. Probability Models: Multiple decrement models, deterministic and random survivorship groups, associated single decrement tables, central rates of multiple decrement, net single premiums and their numerical evaluations.
3. Distribution of aggregate claims, compound Poisson distribution and its applications. Distribution of aggregate claims, compound Poisson distribution and its applications.
4. Principles of compound interest: Nominal and effective rates of interest and discount, force of interest and discount, compound interest, accumulation factor, continuous compounding.

5. Life insurance: Insurance payable at the moment's of death and at the end of the year of death-level benefit insurance, endowment insurance, differed insurance and varying benefit insurance, recursions, commutation functions.
6. Life annuities: Single payment, continuous life annuities, discrete life annuities, life annuities with monthly payments, commutation functions, varying annuities, recursions, complete annuities-immediate and apportion able annuities-due.
7. Net premiums: Continuous and discrete premiums, true monthly payment premiums, apportion able premiums, commutation functions, and accumulation type benefits. Payment premiums, apportion able premiums, commutation functions accumulation type benefits.
8. Net premium reserves: Continuous and discrete net premium reserve, reserves on a semi continuous basis, reserves based on true monthly premiums, reserves on an apportion able or discounted continuous basis, reserves at fractional durations, allocations of loss to policy years, recursive formulas and differential equations for reserves, commutation functions.
9. Some practical considerations: Premiums that include expenses-general expenses types of expenses, per policy expenses. Claim amount distributions, approximating the individual model, stop-loss Insurance.

References:

1. Actuarial Mathematics', Society of Actuaries, Itasca, IIIinois, U. S. A. Second Edition (1997)
2. Spurgeon E. T. (1972): Life Contingencies, Cambridge University Press.
3. Neill, A.: Life Contingencies, Heinemann

Elective-IV

MASI 42341: TIME SERIES ANALYSIS

1. Time-series as discrete parameter stochastic process. Auto covariance and auto correlation functions and their properties.
2. Exploratory Time Series Analysis: Tests for trend and seasonally, Exponential and Moving average smoothing. Hot Wiinters smoothing. Forecasting based on smoothing, adaptive smoothing.
3. Stationary processes: a) moving average) (MA), b) Auto Regressive (AR), c) ARMA and (d) AR integrated MA (ARIMA) models, Box- Jenkins models, Discussion,(without proof) of estimation of mean, auto covariance and auto correlation functions under large sample theory.
4. Choice of AR and MA periods, Estimation of ARIMA models parameters. Forecasting, Residual analysis and diagnostic checking.
5. Spectral analysis of weakly stationary process, Periodogram and Correlogram analysis. Computations based on Fourier transform. Spectral Decomposition of weakly AR process and representations as a one-sided MA process- necessary and sufficient conditions.

References

1. Anderson, T. W (1971): The Statistical Analysis of Time Series, Wiley, N.Y.
2. Brockwell, P.J. and Davis, R. A. Time-Series: Theory and Methods (Second Edition), Springer-Verlag.

3. Box, G.E.P. and Jenkins, G.M. (1976): Time Series Analysis-Forecasting and control Hodlen-day, San Franciscor.
4. Kendall, Sir Maurice and Ord. J. K. (1990): Time Series (Third Edition) Edward Arnold.
5. Montgomery, D. C. and Johnson, L. A. (1977): Forecasting and Time Series Analysis, McGraw Hill.

MASI 42342: PLANNING AND ANALYSIS OF INDUSTRIAL EXPERIMENTS

1. A review of basic concepts of designs of experiment.
2. Factorial Experiments: Concepts of main effects, interaction, Analysis of Full 2^n and 3^n factorial designs, Analysis of single replicate of 2^n and 3- design.
3. Confounding: Total and partial confounding, construction and analysis of 2n and 3n confounded design.
4. Fractional replication for symmetric factorials, concept of aliasing, resolution and minimum aberration, construction of 2^{n-k} design, analysis of 2^{n-k} replicated and single replicate design.
5. Response surface experiments: linear and quadratic model, stationary point, central composition design.
6. Taguchi methods: Concept of loss function, S/N ratio. Linear graphs, inner and outer arrays, ANOVA.
7. Random effects model for one-way classification.

References

1. Jeff Wu C.F., Hamada M. (2000): Experiments: Planning, Analysis and parameter design optimization, John Wiley & Sons.
2. Phadke M.S. (1989): Quality Engineering using Robust Design, Prentice-Hall.
3. Montgomery D.C. (2001): Design and Analysis of Experiments 5th edition, Wiley New York.

Elective- V

MASI 42451: INDUSTRIAL STATISTICS

1. Basic concept of quality control, process control and product control, seven SPC tools Flowchart. Histogram, Check sheet. Ishikawa diagram, Pareto chart, Defect concentration diagram, control chart. Deming's PDCA cycle for continuous improvements and its applications.
2. Control charts for measurements and attributes $\bar{x}$. R. S, p, np. Charts with sub-grouping, CUSUM chart, tabular form and V-mask use of these charts for process control. Moving average and exponentially weighted moving average charts.
3. Process capability Cp, Cpk and Cpm . Determining process capability with $\bar{x}$ chart. Estimation of process capability.
4. Sampling Inspection plans: for attribute inspection: Single, double & sequential sampling plans and their properties. Dodge & Roming characterization by OC curve and ARL-Inspection by variables for one or two sided specifications.
5. Multivariate control charts for measurements data. Hotelling T^2 control charts.
6. Introduction to Six-Sigma Methodology. DMAIC cycle & case studies.

7. Simulation of X -bar and R control charts, estimation of ARL and process capability indices.

References:

1. Guenther W.C (1981): Sampling Inspection in Statistical Quality Control Charter Grifits.
2. Montgomery D.C. (1996): Introduction to Statistical Quality Control, John Wiley & Sons Inc.
3. Kotz S. (1993): Process capability indices. Chapman and Hall.
4. Abraham Bovas (1998) Quality Improvement through statistical methods. Birkhauser.

MASI 42452: STATISTICAL DECISION THEORY

1. Decision theory – Description of the problem, Estimation, Testing and interval estimation as decision problems; randomised, non-randomised and behavioural decision rules and their risk functions.
2. The concept of prior distributions, various types of priors, noninformative , Jeffrey's, least favorable prior, posterior distribution; Posterior distribution conjugate family and standard examples of such families. Bayes and minimax rules; geometric interpretation for finite parameter space.
3. Construction of minimax rules using Bayes rules. Bayes rules for estimation, testing and confidence region problems, Relation between minimax and Bayes rules Extended and Generalized Bays rules.
4. Complete and minimal complete classes; essentially complete classes; Admissible rules; related theorems; Bayes and admissible rules Admissibility of aX + b for EX. inadmissibility of sample mean vector for the mean vector of normal distribution.
5. Invariance, Maximal invariance of a function. Invariant decision problem. Invariant rule. Invariant estimators and tests UMPI tests.

References:

1. Ferguson T. S. (1967): Mathematical Statistics Decision Theoretic Approach, Academic Press.
2. Degroot H.: Optimal Statistical Decisions.
3. Berger J. O. (1980): Statistical Decision theory – Foundations, Concepts and Methods, Springer Verlag
4. Zacks(1971): Theory of Statistical Inference, John Wiley & Sons, Inc.
5. Lehmann E L: Theory of Point Estimation

Elective-VI

MASI 42561: DATA WAREHOUSING AND DATA MINING

1. Introduction: Data Warehouse and OLAP Technology: Data warehouse concept, multidimensional data model, data warehouse architecture, from data warehousing to data mining. Data Preprocessing: Descriptive data summarization, data cleaning, data integration and transformation, data reduction
2. Introduction: Data mining concepts, Data mining functionalities, classification of data mining systems, Integration of data mining system with a database or data warehouse system, major issues in data mining. Mining frequent patterns, Associations and

Correlations: Basic concepts and road map, efficient and scalable frequent item set mining methods,

3. Classification and Prediction: Concept of classification and prediction, issues regarding Classification and prediction, classification by decision tree induction, Bayesian classification, rule-based classification, classification by backpropagation, support vector machines, lazy learners, other classification methods.
4. Cluster analysis: Concept of cluster analysis, types of data in cluster analysis, a categories of major clustering methods, partitioning methods, hierarchical methods, data mining applications.

Reference

1. Jiawei Han and Micheline Kamber: Data Mining Concepts and Techniques
2. Sam Anahory, dennis murray: Data Warehousing in Real World
3. Amitesh Sinha: Data Warehousing
4. Pieter Adriuans, dolf zantinge: Data Mining
5. Rajan Chattamvelli: Data Mining Methods
6. Arun Pujari: Data Mining Methods

MASI 42562: ARTIFICIAL INTELLIGENCE

1. AI Problem solving: Historical development of AI, Role of heuristic in problem solving, Knowledge representation and inference, Comparison of database with knowledgebase, Expert Systems: Expert problems, Expert system case study, Predicate logic, Fact-table, Rulebase, Fuzzy logic, Case based reasoning, Design of fuzzy rulebase, Construction and implementation of knowledgebase systems.
2. Artificial Neural Networks & Genetic Algorithms: Signal processing in biological and artificial neurons, ANN architectures, Perceptron learning, Training and implementation of a neural network
3. Genetic Algorithms: History and evolution of G.A, Modeling a problem for the application of G.A.—Representation of data in chromosomes, Fitness function, reproduction and convergence, Comparison of ANN and GA, Applications of G.A.
4. AI research: Natural Language Processing—Text categorization, text summarization and Text elaboration, Vision and perception, image analysis and pattern matching, Robotics

References

1. S.Rajsekaran, G.A. Vijayalaxmi Pai: Neural Networks, Fuzzy Logic and Genetic Algorithms, Synthesis and Applications, (EEE)
2. David Goldberg: Genetic Algorithms (Addison and Wesley)
3. David Rolston: Principles of AI and Expert System Development (MGH)
4. E. Ritch and K. Knight: Artificial Intelligence (MGH)