MA801  FUZZY LOGIC AND NEURAL NETWORKS  4-0-0-4

Fuzzy systems; Pattern recognition; Engineering Applications- Civil, Mechanical, Industrial, and Computer Engineering, and Reliability theory and Robotics.

TEXT BOOKS/ REFERENCES:

MA802  PROBABILITY AND APPLIED STATISTICS  3-1-0-4


TEXT BOOKS / REFERENCES:
MA803        FOURIER TRANSFORM AND WAVELET TRANSFORM        3-1-0-4


Continuous Wavelet Transform: Introduction-Continuous-Time Wavelets- Definition of the CWT-The CWT as Correlation-Constant Q-Factor Filtering Interpretation and Time –Frequency Resolution -The CWT as an Operator-Inverse CWT-Problems

Discrete Wavelet Transforms: Introduction-Approximations of Vectors in Nested Linear Vector Subspaces –Example of Approximating Vectors in Nested Subspaces of a Finite- Dimensional Linear Vector Space-Example of Approximating Vectors in Nested Subspaces of a Infinite-Dimensional Linear Vector Space –Example of an MRA-Bases for the Approximation Subspaces and Harr Scaling Function –Bases for the Approximation Subspaces and Harr Wavelet

TEXT BOOKS / REFERENCES:


MA804        GRAPH THEORY        3-0-1-4


Tree: Tree, properties of Trees, distances and centers in a tree, spanning tree, Fundamental Circuits, minimal, maximal spanning tree-rooted binary trees. Vertex and Horizontal constrained graphs, interval, permutations and intersection graphs with simple properties.

Computational Complexity: Introduction to NP completeness, the classes of P and NP, Tractable and Intractable algorithms, Cooks theorem.


TEXT BOOKS / REFERENCES:


**MA805 STATISTICAL INFERENCE AND DESIGN OF EXPERIMENTS 3-1-0-4**

Point and Interval Estimation: General concepts - unbiased estimators - Variance and mean square error of an estimator - Methods of point estimation - Confidence interval development for population parameter – mean, variance, proportion – small and large sample cases – Bayes interval estimation.

Tests of Hypotheses: Hypothesis testing – general procedure for hypothesis testing – power of a test –alpha and P-values, choice of sample size, application of various test statistics with the respective distributional properties.

Analysis of Variance and Design of Experiments: Design and analysis of single-factor experiments – model development of completely randomized experiments – multiple comparisons – Randomized block designs – Tests and assumptions based on fixed and random effects models – Design of experiments with several factors – Factorial experiments – General factorial experiments – $2^k$ factorial experiments – Blocking and confounding – Response surface methodology – Orthogonal experiments.

**TEXT BOOKS/REFERENCES:**


**MA806 REGRESSION ANALYSIS 3-1-0-4**


**TEXT BOOKS / REFERENCES:**


Non-Linear Stationary Models: Introduction-Three explicit forms for the ARIMA Model-Integrated Moving Average process.

Forecasting: Principles of forecasting-Forecast based on an infinite number of observations – Forecast based on a finite number of observations –the triangular factorization of a positive definite symmetric matrix-updating a linear projection-optimal forecasts for Guassian processes-sums of ARMA processes-Wold’s decomposition and the Box Jenkins modeling

TEXT BOOKS /REFERENCES:


TEXT BOOKS /REFERENCE
Structure of Finite Fields: Characterization of Finite Fields, Roots of Irreducible polynomials, Traces, Norms and Bases, Roots of Unity and Cyclotomic Polynomials, Representation of Elements of Finite Fields.


Permutation Polynomials: Criteria for Permutation Polynomials, Special Type of Permutation Polynomials, Groups of Permutation Polynomials, Exceptional Polynomials, Permutation Polynomials in several indeterminate.

TEXT BOOKS / REFERENCES:

MA810 COMPUTER AIDED DESIGN OF VLSI CIRCUITS 3-1-0-4


TEXT BOOK / REFERENCES:

MA811 VLSI ROUTING ALGORITHMS 4-0-0-4


Thin-Film MCMs: Minimum Width Cell Layouts – Multitrow Net Connection Assignment – Net Classification – Interval Selection Topological Routing Approach.

TEXT BOOKS /REFERENCES:

MA812 FUNCTIONAL ANALYSIS 3-1-0-4


TEXT BOOKS / REFERENCES:

MA813 TENSOR ANALYSIS AND FINITE ELEMENT METHODS 3-1-0-4

Introduction to Vector and Tensor analysis: Vectors – Vector Spaces - Tensors - Differential forms – Variational principles – n\textsuperscript{th} rank tensor in m dimensional space – Cartesian Tensors - Theory and applications to geometry and Mechanics – Tensor analysis on manifolds.

Introduction to FEM : General procedure for finite element analysis - Types of finite elements in one, two and three dimensions - Shape functions, Interpolation functions for general finite element formulation - Convergence criteria, compatibility requirements, geometric isotropy invariance.


Solution Techniques: Numerical integration – Gaussian quadrature – Wilson θ method
Direct methods – Gauss elimination method, Choleski decomposition, frontal method
Iterative techniques – gradient based methods and preconditioners - Eigen Values

TEXT BOOKS /REFERENCES:

MA814 NETWORK ON CHIP 2-0-1-3

Graph terminologies – Types of Graphs- Graph Algorithms: Shortest Path-Maximal Flow-
Minimal Spanning Tree-Graph Partitioning.
Introduction to NoC-SoC objectives and NoC needs-Network Architecture for on chip relations-
Ad HOC Network Architectures-Component Design for NoCs-Properties of Network
Architecture.
Physical Network Layer: Interconnection in DSM SoC-High performance Signaling-Buliding
Blocks.
Network and Transport Layers in NoC: NoC QoS-NoC Topology-Switching Techniques-NoC
Routing-NoC Addressing-Congestion and Flow control.
NDesign Methodologies and CAD Tol Flows for NoCs: Network Analysis and Simulation-
Network Systhesis and Optimization-Design flow for NoC.

TEXT BOOKS / REFERENCES
Kauffmann Publisher, 2006.
4. Nicopoulos, Chrysostomos and Narayanan, “Network-on-Chip Architectures: A

MA815 MATHEMATICAL FOUNDATIONS OF INCOMPRESSIBLE FLUID FLOW 4-0-0-4

Kinematics of Fluids in motion – Lagrangian and Eulerian methods – Equation of continuity –
Boundary conditions – Kinematic and physical – steam line, path line and streak line – velocity
potential – vorticity- rotational and irrotational motion.
Equation of Motion of Compressible Viscous Fluid (Navier-Stokes Equations)-General Properties
–Equation of motion of inviscid fluid – Euler’s equation – impulsive force –physical meaning of
velocity potential-energy equation – Lagrange’s hydrodynamical equations — Bernoulli’s
equation and its applications-Motion in two-dimensions and sources and sinks – irrotational
motion – complex potential-Milne-Thomson circle theorem –Blasius theorem. General theory of
irrotational motion – flow and circulation – Stoke’s theorem – Kelvin’s Circulation theorem –
Permanence of irrotational motion - Kelvin’s minimum energy theorem Viscous Incompressible
flow - Dimensional Analysis – Buckingham π theorem. Exact Solutions of Navier Stokes
Equations – Small Reynold’s number flows – flow past a sphere –Stokes flow – Whitehead’s
paradox- Flow past a circular cylinder – Stoke’s Paradox.
TEXT BOOKS / REFERENCES:

MA816 MATHEMATICAL THEORY OF MAGNETOHYDRODYNAMICS 4-0-0-4


TEXT BOOKS / REFERENCES:

MA 817 GEOPHYSICAL FLUID DYNAMICS 3-0-0-3


TEXT BOOKS / REFERENCES:
MA818 ADVANCED BOUNDARY LAYER THEORY 4-0-0-4

Introduction – limitations of ideal fluid dynamics – Importance of Prandtl’s boundary layer theory - boundary layer equations in two dimensional flows – boundary layer flow over a flat plate – Blasius solution – Boundary layer over a wedge – energy integral equation for two-dimensional laminar boundary layers in incompressible flow – application of Von Karman’s integral equations to boundary layer with pressure gradient

TEXT BOOKS /REFERENCES:

MA819 GENERALIZED MATRIX FUNCTIONS 4-0-0-4

Matrices: Matrices of 0’s and 1’s, lower and upper bounds for permanent of (0, 1) matrices, Non-negative, positive definite, doubly stochastic matrices, and Hermitian matrices.
Multilinear Algebra: Generalized Cramer’s rule. Generalized inverse, diversity of generalized inverses, Jordan and Smith normal forms. Moore-Penrose inverse, {1}, {1,2}, {1,2,3} inverses, and Bott-Duffin Inverse.

TEXT BOOKS /REFERENCES:

MA820 VECTOR BUNDLES 3-0-0-3

TEXT BOOKS / REFERENCES:

MA 821 THEORY OF MANIFOLDS 3-0-0-3


TEXT BOOKS / REFERENCES:

MA 822 LIE ALGEBRAS 4-0-0-4


TEXT BOOKS / REFERENCES:

MA 823 LIE GROUPS 4-0-0-4


TEXT BOOKS / REFERENCES:

MA 824 REPRESENTATION THEORY OF LIE ALGEBRAS 4-0-0-4


TEXT BOOKS / REFERENCES:

MA825 SPECTRAL GRAPH THEORY AND ITS APPLICATIONS 3-0-0-3

Adjacency matrix and Laplacian, Intuition, spectral graph drawing, Physical intuition Isomorphism testing.
Random walks. Graph Partitioning and clustering, Distributions of eigenvalues and compression, Computation.
Energy minimization.
Randomized algorithms and Markov chains. Construction of expander graphs.

**TEXT BOOKS / REFERENCES:**

3. C. Godsil and G. Royle. *Algebraic Graph Theory*. Graduate Texts in Mathematics 207, Springer

**MA 826**

**PROBABILITY THEORY**

4-0-0-4


**TEXT BOOKS/ REFERENCES:**


**MA827**

**CENTRALITY AND CONVEXITY IN GRAPHS**

3-0-0-3


Convexities- geodetic convexity, convex hulls. Closure invariant – geodetic iteration numbers, convexity numbers, geodetic numbers and hull numbers. Geodetic and hull numbers and related metric sets on product graphs – Cartesian and strong product of graphs, Order and Metric Convexities in z raised to the power n.

Transit functions on graphs – geodetic transit function, induced path transit function, all path transit function, cut-vertex transit function, detour transit function. The Single paths transit functions and longest path transit functions, Transit functions on POsets.

**TEXT BOOKS/ REFERENCES:**
1. F. Buckley and F. Harary, “Distance in Graphs”, Addison-Wesley, Redwood city, CA, 1990. (chapters 2 and 7)

MA 828 ADVANCED NUMERICAL ANALYSIS 3-0-0-3

2. Stability and Convergence Analysis to be made for relevant methods above.

TEXT BOOKS/REFERENCES:

MA 829 STATISTICAL METHODS IN BIOINFORMATICS 4-0-0-4

Introduction to bioinformatics, Markov chains and HMM, parameter estimation for HMM, Complex Markov Chains, numerical stability of HMM, pair wise alignment using HMM, profile HMMS for sequence families, adding insert and delete states to obtain profile HMMS, searching with profile HMM. Probabilistic approaches to phylogenetic tree, Maximum Parsimony analysis, Fitch-Margoliash algorithm for the three sequences, Jukes-Cantor model of sequence evolution, Minimum evolution (ME) methods, Evolutionary models based on gene expressions and micro-array data, Bootstrapping, calculating likelihood for ungapped alignments, Maximum Likelihood.

**TEXT BOOKS/REFERENCES:**


**MA 830**  
**RAMSEY THEORY**  
4-0-0-4


**TEXT BOOKS/REFERENCES:**