Department of Computer Science
Assam University
Revised Syllabus

M. Sc. (Computer Science), A Post Graduate Degree Course
Under CBCS Pattern
2010-11
Department of Computer Science
Assam University, Silchar

CREDIT BASED CHOICE SYSTEM (CBCS)

Course Structure for M.Sc. (Computer Science)-A Post Graduate Degree Course under CBCS

SEMESTER: I

Course Code	Course Name	L	T	P	C	Sessional Marks	End Semester Marks	Total Marks
MS 101	Theory of Computation	4	1	..	5	25	75	100
MS 102	Design and Analysis of Computer Algorithms	4	1	..	5	25	75	100
MS 103	Artificial Intelligence	4	1	..	5	25	75	100
MS 104	Wireless and Mobile Computing	4	1	..	5	25	75	100
MS 105	Laboratory – 1 (a) Design and Analysis of Computer Algorithms (b) Artificial Intelligence			8 4 4	5	25 13 12	75 37 38	100

SEMESTER: II

Course Code	Course Name	L	T	P	C	Sessional Marks	End Semester Marks	Total Marks
MS 201	Software Engineering	4	1	..	5	25	75	100
MS 202	Principles of Compiler Design	4	1	..	5	25	75	100
MS 203	Modeling and Simulation	4	1	..	5	25	75	100
MS 204	Digital Image Processing	4	1	..	5	25	75	100
MS 205	Laboratory – 2 (a) Principles of Compiler Design (b) Image Processing and Modeling and Simulation			8 4 4	5	25 13 12	75 37 38	100

SEMESTER: III

Course Code	Course Name	L	T	P	C	Sessional Marks	End Semester Marks	Total Marks
MS 301	Data Mining and Knowledge Discovery	4	1	..	5	25	75	100
MS 302	Term Paper and Grand Viva			..	5	25	75	100
MS 303	Neural Network	4	1	..	5	25	75	100
MS 304	Elective –I	4	1	..	5	25	75	100
MS 305	Laboratory – 3 (a) Data Mining and Knowledge Discovery (b) Artificial Neural Network			8 4 4	5	25 13 12	75 37 38	100

SEMESTER: IV

Course Code	Course Name	L	T	P	C	Sessional Marks	End Semester Marks	Total Marks
MS 401	Distributed Computing	4	1	..	5	25	75	100
MS 402	Fuzzy Set Theory and Applications	4	1	..	5	25	75	100
MS 403	Cryptography	4	1	..	5	25	75	100
MS 404	Elective –II	4	1	..	5	25	75	100
MS 405	Project work			8	5	25	75	100

List of Electives:

The students are required to choose one option for each of the courses from the list below. However, offering of a particular subject depends on the availability of concerned faculty

Course Code	Options (Any one of the following)
MS 304: Elective - I	a) Advanced Operating System b) Computer Vision c) Advanced Computer Architecture and Parallel Computing d) Operations Research e) VLSI Design f) Natural language Processing g) Distributed Data Base Systems
MS 404: Elective –II	a) Evolutionary Computation b) Machine Learning c) Computational Geometry d) Clustering and Grid Computing e) Pattern Recognition f) Quantum Computation g) Embedded Real Time Systems h) Digital Signal Processing

L: Lecturer Hrs/Week T: Tutorial P: Practical Hrs/Week C: Credits S: Sessional Marks
E: End Semester Marks TM: Total Marks

Total Marks / Semester – 500

Semester - I

MS 101: Theory of Computation

Unit I

Sets, Relations and Functions, Fundamental Proof Techniques, Alphabets, Strings and languages, Finite and Infinite sets, Finite Representation of Languages, Regular Expressions, Deterministic and Nondeterministic Finite Automata (DFA and NFA), Equivalence of DFA and NFA.

Unit II

Properties of the languages Accepted by Finite Automata, State Minimization of a DFA, Pumping Lemma for Regular Sets, Regular and Non-regular languages.

Unit III

Context-free Grammars, Parse Trees, Regular Language and context free language, Chomsky's Normal Form, Pushdown Automata, Properties of Context Free Languages, Pumping Lemma for Context Free Languages, Determinism and Parsing.

Unit IV

The definition of a Turing Machine, Computing with TM, Recursive and Recursively Enumerable Language, Extensions of Turing Machines, Non Deterministic Turing Machines, Chomsky's Hierarchy.

Unit V

Primitive and *n*-Recursive Function, Church's thesis, The Halting problem, Unsolvability, Computational Complexity.

Text Books/References:

1. H. R. Lewis & C. H, Papadimitriou, Elements of the Theory of Computation, PHI, 1981.
2. J. E. Hopcroft, R. Motwani & J. D. Ullman, Introduction to Automata Theory, Language and Computation, 3rd Ed., Prentice Hall, 2007.
3. K. L. P. Mishra, N. Chandrasekaran, Theory of Computer Science: Automata, Languages and Computation, 3rd Ed., PHI, 2006.
4. John Martin, Introduction to languages and Theory of Computation, McGraw Hill, 2003.
5. D. A. Cohen, Introduction to Computer Theory, John Wiley and Sons, 1986.

MS 102: Design and Analysis of Computer Algorithms

Unit I

Definition of an Algorithm, writing structured programs, asymptotic notations (O, Θ, Ω), Solution of Recurrences: Substitution method, iteration method and the master method, stack and queues, heap and heap sort, hashing.

Unit II

Divide and conquer: the general method, binary search, finding the maximum and minimum, merge sort, quick sort, strassen's matrix multiplication, analysis of search, insertion and deletion in trees.

Unit III
Graph Algorithms: Representation of graphs, Breadth-first search, depth-first search, strongly connected components, topological sort, algorithms of Kruskal and Prim, single source shortest path algorithms and all pair shortest path algorithms, String matching algorithms, string matching with finite automata.

Unit IV
Dynamic programming: the general method, multistage graphs, optimal binary search trees, the traveling sales persons problem, Greedy method: Knapsack problem, Huffman codes, Lower bound theory.

Unit V
Computational geometry algorithms: Graham's scan algorithm, finding the closest pair of points, Backtracking, NP-HARD and NP complete problems.

Text Books /References:

1. Thomas H. Cormen *et al.*, Introduction to Algorithms, PHI, 2001
2. Ellis Horowitz, Sartraj Sahni, Fundamentals of Computer Algorithms, Galgotia Publication, 1984.
3. S.K.Basu, Design Methods and Analysis of Algorithms, PHI, 2005
4. Sahni, Data Structures, Algorithms and Applications in C++, McGraw Hill, 2000.
5. Aho A.V, Hopcroft, J.E. Ullman, Design and analysis of computer algorithms, Addison-Wesley, 1975.
6. Brassard and Bratley, Fundamentals of Algorithmics, PHI, 2001.
7. A. M. Tanenbaum, Data Structure using C, Pearson Prentice Hall, 1998.

MS 103: Artificial Intelligence

Unit I
Definition, Short History of Artificial Intelligence (AI), Brief Discussion of Major Topics (Expert System, Natural Language Processing, Speech and Pattern Recognition etc.) of AI. Problem Definition as a State Space Search, Production System, Control Strategies, Problem Characteristics.

Unit II
Forward Versus Backward Reasoning, Matching, Indexing, Search Techniques, Depth-First and Breadth-First Search Technique Best First Search, A*, AO* algorithms Adding Heuristics, Hill-Climbing, Search Technique, Problem Reduction, Constraint Satisfaction, Game Playing.

Unit III
Knowledge Representation in predicate and Prepositional Logic, Resolution in Predicate & Prepositional Logic, Deduction and theorem Proving, Question Answering, Structured Representation of knowledge declarative representation semantic networks conceptual dependencies frames and scripts procedural representation.

Unit IV
Overview of Expert System, Design of Rural-Based Expert System, Selecting a problem for expert system development. The knowledge Engineering Process, Conceptual models and their role in Knowledge acquisition.

Unit V
AI language & their important characteristics, Overview of LISP and PROLOG, Computer Architectures for AI Application, LISP Machines & Parallel Machines.

Note: Implementation in LISP or PROLOG.

Text Books/References:

1. E. Rich *et al*., Artificial Intelligence, Tata McGraw Hill, 2009.
2. P.H. Winston & B.P.Horn, Lisp, A.Wesley, 1984.
3. E. Charniak & D.Mc Dermott, Introduction to Artificial Intelligence, A.Wesley, 1985.
4. P.H. Winston, Articial Intelligence, 3rd Edition, A.Wesley, 1992.
5. S. Garavaglia, PROLOG Programming Techniques and Application, Harper and Row, 1987.
6. A.Barr & E.A.Feigenbaum, the Handbook of Artificial Intelligence, Los Altos, 1981.

MS 104: Wireless and Mobile Computing

Unit I

Introduction to Wireless Communication Systems: Evolution of wireless/mobile radio communications, mobile radio systems around the world, radio communication systems: paging systems, cordless telephone systems, cellular telephone systems; comparison of common wireless communications, trends in cellular radio and personal communication, second generation (2G) cellular networks, third generation (3G) wireless networks, introduction to radio wave propagation, Concepts of free space propagation model.

Unit II

Wireless networking: Wireless local area network standards, technology – RF and IR wireless LAN, diffuse, quasi-diffuse and point-to-point IR wireless LAN, advantages and applications of Wireless LAN, intro. to WI-FI, Bluetooth, 3G & 4G wireless systems.

Unit III

Basics of Mobile Technology, Brief history of Mobile Computing, Terrestrial cellular telephony: cellular concept, cell cluster, frequency reuse, mobile station (MS), base station (BS), Mobile switching center (MSC), Different cellular standards, digital cellular systems, TDMA and CDMA systems, global system for mobile communication (GSM) standard, GSM network, control function, call setup, call handling, mobility management.

Unit IV

Cellular digital packet data (CDPD) system: IP based mobile system, general packet radio service (GPRS). Switching and Traffic: intelligent cell concepts, intelligent network communication, and wireless local loop Antennas for cellular systems: multi-path and fading in signals, co-channel suppression, and GMSK modulation. Mobile Computing Complexities, Algorithms. Spread spectrum communication, Analysis of spread spectrum,

Unit V

Satellite mobile communication: Orbital mechanics: GEO, MEO, LEO system, Satellite links: direct broadcast satellite receiving system, earth station design, VSAT, analog and digital transmission of voice and TV signals, bandwidth compression, principles of FDMA, TDMA, CDMA, SPADE, DMAS, Global positioning system: basic principles of position fixing with GPS, errors in position fixing, DGPS, WAAS, GPS application. Case study on Google earth.

Text Books:

1. Talukder & Roopa Yavagal, Mobile Computing, Tata McGraw Hill, 2010.
2. Stallings, Wireless communication and Networks, 2nd Edition, Pearson Education, 2005.

References:

1. Comer, Computer Networks and Internets, 4th Edition, Pearson Education, 2004.
2. U. D. Black, Data Communications and Distributed Networks, 3rd Ed., PHI, 1992.

MS 105: Laboratory – 1

(a) Practical on Design and Analysis of Computer Algorithms
(b) Practical on Artificial Intelligence

(a) **Practical on Design and Analysis of Computer Algorithms**
Problems related to Design and Analysis of Computer Algorithms should be solved by using the Programming languages C/C++/JAVA (preferably on Unix/Linux/Solaris operating systems environment on a network). Following are some areas of Design and Analysis of Computer Algorithms for laboratory programming assignments but the assignments should not be limited to these only.

1. Stack and queues, tree, heap and heap sort, graphs and hashing.
2. Divide and conquer method: binary search, merge sort, quick sort, matrix multiplication, minimum spanning tree.
3. Dynamic programming: multistage graphs, all pair shortest paths, optimal binary search trees/I knapsack, travelling sales persons problem, flow shop scheduling.
4. Search and traversal techniques: AND/OR graphs, game trees, bi connected components and depth search.
5. Backtracking: Hamilton cycles, the fast Fourier transform, NP-HARD and NP complete problems.

(b) **Practical on Artificial Intelligence**
Problems related to Artificial Intelligence should be solved by using the Programming languages PROPOG/LISP. Following are some areas of Artificial Intelligence for laboratory programming assignments but the assignments should not be limited to these only:

1. State Space Search, Production System, Control Strategies
2. Search Technique: Depth-First and Breadth-First Search, First Search, A*, AO* algorithms, Adding Heuristics, Hill-Climbing, Constraint Satisfaction, Game Playing.
3. Knowledge Representation: Predicate and Prepositional Logic, Resolution in Predicate & Prepositional Logic, Deduction and theorem Proving, Question Answering, Knowledge representation, Semantic networks, Frames and scripts.
4. Expert System, Design of Rule-Based Expert System, Knowledge Engineering, Conceptual models and Knowledge acquisition.

Note: Implementation in LISP and/or PROLOG.

Semester - II

MS 201: Software Engineering

Unit I
Importance of software, Characteristics, Components, Applications of Software, Software Myths. Definition of the Classic Life Cycle, Prototyping, the Spiral Model, Fourth- Generation Techniques. Planning and Management of software Project : People, problem and process, measures, matrices and indicators, matrices for software quality, scooping, software project estimation, make-buy decision, software acquisition.

Unit II
Software risks: Identification, Projection assessment, monitoring, Project scheduling and tracking tasks/work breakdown structures, timeline chart, project plan, CASE tools. Requirement analysis: Communication techniques. FAST, quality development, analysis principles, modeling, partitioning, prototyping, specifications, SRS and SRS reviews, analysis models : data modeling, functional modeling and information flow, Data flow diagrams, extensions to real-time systems, behavioral models, mechanics of structured analysis, ER diagrams, control modeling, data dictionary CASE tools.

Unit III
Design Fundamentals: Software design and software design process, principles and concepts, abstraction, refinement and modularity, software architecture, control hierarchy, partitioning, data structure, information hiding, effective modular design, cohesion, coupling, design module, design document.
Design Method: Architectural design and design process, transform and transaction flow, design steps, Interface design, procedural design, graphical and tabular design notations.

Unit IV
Software testing and testing strategies : Software testing fundamentals, test case design, white-box, black-box testing, control structure testing, strategic approach to testing, strategic issues, unit testing, integrated testing, validation testing, system testing.

Unit V
Software quality concepts, Software quality assurance (SQA) and approaches, Software Reliability, SQA plan, ISO 9000 and SEI standards for software, software configuration management (SCM), base lines, scan process, version control, change control, SCM audits.

Text Books/References:

1. Roger Pressman, Software Engineering: A Practitioner's Approach, 7th Ed., TMH, 2009.
2. P. S. Pressman, Software Engineering, McGraw Hill, 2009.
3. Pankaj Jalote, An Integrated Approach of Software Engineering, Narosa, 1991.
4. M. Shooman, Software Engineering, 2nd Edition, McGraw Hill, 1983.

MS 202: Principles of Compiler Design

Unit I
Overview of process, some compiler structures, Regular expression, finite automata and Lexical Analysis, Syntax tress, ambiguity, context free grammar & derivation of parse trees, basic-parsing techniques, and deduction.

Unit II
Syntax – Direction Translation: Top-down and bottom-up parsing operator precedence parsing, LR parsers, syntax directed definition, translation schemes, L-attributed & S-attributed definition.

Unit III
Symbol Tables: The contents of a symbol table, Data structures for symbol table (ST), design of ST, ST for block structured languages.
Run-time storage administration: Storage allocation strategies, static dynamic & heap memory allocation, memory allocation in block structured languages, memory allocation in recursion, and memory allocation in FORTRAN.

Unit IV
Code optimization: Principal sources of Optimization, Loop Optimization, Global data Flow Analysis, Some other loop organizations.

Unit V
Code Generation: Object programs, Problems in code generation, a machine model. A simple code generator, Register allocation and assignment, Peephole optimization

TextBooks/References:

1. D. M. Dhamdhere: Complier Construction – principles & practice (McMillan)
2. A. V. Aho, R. Sethi & J. D. Ullman : compiler-principles, techniques & tools (A.Wesley)
3. J. Trembley & P. G. Sorrenson : The theory and practice of compiler writing (McGraw)
4. W. A. Barrett et al: compiler construction theory & practice (Galgotia)
5. D. Gries : compiler construction for digital computer (JW)
6. A. V. Aho and J. D. Ullman : Principles of Computer Design, (Narosa Publishing House)

MS 203: Modeling and Simulation

Unit I
System models and role of simulation: Basic concept and nomenclature, Type of system – deterministic, stochastic, continuous and discrete system, System simulation – uses of simulation and its limitations, steps in simulation studies, Random variate generation for Uniform, Exponential, Normal and Poisson distributions, Sampling and estimation, Maximum ;likelihood estimation, Confidence interval estimation.

Unit II
Discrete Event Simulation : Representation of time, Approaches to discrete event simulation, Queuing models – single and multiserver queues, steady state behavior of queues, network of queues, Inventory system simulation, Programming languages for discrete event system simulation – GPSS,SIMSCRIPT (brief overview).

Unit III
Modeling and performance evaluation of computer system : Behavioral, data flow and structure modeling, overview of hardware modeling and simulation using VHDL, VHDL description for design reuse, test generation and fault simulation for behavioral model, Single server Centre models, central server models of interactive systems, use of VHDL in front-end and back-end system development, Evaluation of multiprocessor systems, workload characterization & benchmarks.

Unit IV
Continuous system simulation : Continuous system models- open and closed loop system, Models decribed by differential equations, System dynamics, Growth and decay models, Systems dynamics diagram, Simulation of aircraft models, Biological and sociological system simulation, Simulation languages overview – CSMP.

Unit V
Virtual reality modeling : Overview of Virtual reality modeling language VRML 2.0, creating dynamic worlds, Integrating Java scripts with VRML, Verification and validation of simulation models- Goals of model verification and validation, Input data analysis, Output analysis, Sensitivity analysis, Hypothesis testing, Performance measures and their estimation.

Text Books/References:

1. J. E. Banks and J. S. Carson II “Discrete System Simulation”, Prentice Hall, Englewood Cliff, NJ.
2. G. Gordon, System Simulation, Prentice Hall, Inc., Englewood Cliffs, NJ, 1969.
3. D. Ferrari, Computer System Performance Evaluation, Prentice Hall, NJ.
4. J. Bhasker, Computer System Performance Evaluation, Prentice Hall, NJ.
5. Glenn Vanderburg et al., Tricks of the Java Programming Gurus, Sams. Net Publishing, 1996.
6. Narsing Deo, System Simulation with Digital Computer, PHI, 1979.

MS 204: Digital Image Processing

Unit I

Digital image fundamentals - Concept of gray levels. Gray level to binary image conversion. Sampling and quantization. Relation ship between pixels. Imaging Geometry

Image Transforms 2-D FFT, Properties. Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform, Hotelling transform

Unit II

Image enhancement Point processing. Histogram processing. Spatial filtering. Enhancement in frequency domain, Image smoothing, Image sharpening

Unit III

Colour image processing : Psedo colour image processing, full colour image processing.

Image compression Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

Unit IV

Image Restoration Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.

Unit V

Image segmentation Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.

Text Books:

1. R. C. Gonzalez & R.E. Woods, Digital Image processing, Addison Wesley/ Pearson education, 2nd Education, 2002.

References:

1. A. K. Jain, Fundamentals of Digital Image processing, PHI, 1989.
2. Rafael C. Gonzalez, Richard E Woods and Steven L, Digital Image processing using MAT LAB , PEA, 2004.
3. William K. Pratt, Digital Image Processing, John Wiley, 3rd Edition, 2004.
4. Weeks Jr., Fundamentals of Electronic Image Processing, SPIC/IEEE Series, PHI.

MS 205: Laboratory – 2

(a) Principles of Compiler Design
(b) Digital Image Processing and Modeling and Simulation

(a) Practical on Compiler Design

Problems related to Compiler Design should be solved by using the Programming languages C/C++/JAVA as well as various tools for Compiler Construction and Design like LEX, YACC, BYSON etc. Following are some areas of Compiler Design for laboratory programming assignments but the assignments should not be limited to these only:

1. Construction of a lexical analyzer and LL(1) parser for a subset of FORTRAN/PASCAL/C/C++ (to be done without using any generator).
2. Construction of a lexical analyzer and LALR(1)/LR(1) parser for a subset of C/C++ (generators like LEX, YACC, BYSON to be used)
3. A construction of a translator from a high level to an intermediate language which is also a very simple subset of C (The correctness of this translation may be checked by compiling this intermediate program by a standard compiler)
4. Construction of a target code generator from the above intermediate language program to the assembly language of a suitable target machine (e. g. Intel 8088). Addition of rudimentary code optimization (like peep-hole)/jump optimization
5. Register optimization to the generated compiler. Experiments with incorporation of debugging features

(b) **Practical on Modeling & Simulation and Digital Image Processing**

Problems related to Modeling & Simulation should be solved by using the Programming languages C/C++/JAVA as well as various tools for Modeling & Simulation. Following are some areas of Modeling & Simulation for laboratory programming assignments but the assignments should not be limited to these only:

Discrete and continuous simulation procedures, Special purpose simulation languages (use of one language depending on the availability in detail) versus conventional general purpose programming language like C/C++/JAVA in simulation and modeling of large systems

Semester - III

MS 301: Data Mining and Knowledge Discovery

Unit I

Introduction to Data Mining and data Warehousing, What is Data ware house, Definition, Need for data Ware house, DBMS vs. Data Ware house, Multi dimensional data Model, Data Cubes, Ware house Schema, stars, snowflakes, and fact constellations, data ware housing architecture and process, Ware house server, Metadata, Data ware house back end process, Data ware house physical design – partitioning, indexing, integrity constraints, materialized views, Data ware house construction – data extraction, transformation, loading and refreshing.

Unit II

OLAP technique for data ware house, OLAP architecture, operations and OLAP engine, SQL extensions for OLAP, types of OLAP servers, 3-tier data ware house architecture, Data ware house implementation and data warehousing back end tools.

Fundamentals of Data Mining, Definitions, KDD vs Data Mining, Data Mining Functionalities, Data Mining techniques, DBMS vs Data Mining, Classification of data Mining problems, Major issues and challenges of data mining, Data Mining tools and Applications.

Unit III

Association rule mining in large data bases, Definition and types of Association rules, Association Rule Mining Algorithms: A priori, Partition, Pincer Search, Dynamic Item set Counting, FP Tree Growth Algorithms. Discussion on Different Algorithms, Incremental Algorithm, Border Algorithm, generalized Association Rule Mining, Association Rules with item set constraints. Recent trends in Association rule mining.

Unit IV

Clustering techniques: Introduction, clustering paradigms, Categorization of major clustering methods, partitioning algorithms, k-medoid algorithms, CLARA, CLARANS, Hierarchical Clustering, DBSCAN, BIRCH, CURE, Categorical Clustering Algorithms, STIRR, ROCK, CACTUS, Recent trends in Clustering

Unit V

Classification and prediction: Issues regarding classification and prediction, Classification by Decision tree Induction, Bayesian Classification, Classification by back propagation, Other Classification methods, Prediction, Classifier accuracy.

Overview of Advanced data mining techniques: WEB Mining, Spatial Mining, Spatial and Temporal data mining.

Text Books/References:

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Elsevier, Morgan Kaufmann publishers, 2nd Edn, 2006
2. Arun Kumar Pujari, Data Mining Techniques, University press, 2001
3. Margaret H Dunham, Data Mining: Introductory and Advanced topics, Pearson Education, 2006.

MS 302: Term Paper and Grand Viva

Term Paper **Full Marks: 50**

For this course, each student is required to

(i) Select appropriate field of study under the supervision of a faculty of the Department.

(ii) Present a seminar in the beginning after the selection of the topic in presence of the Departmental Committee

(iii) Deliver a final seminar at the end of the semester course work in presence of the Departmental Committee

Grand Viva **Full Marks: 50**

Guide/Supervisor with the Departmental Committee shall evaluate the term paper and grand viva out of 100.

MS 303: Neural Network

Unit I

Introduction to Neural Networks: Biological and Artificial Neurons, Perceptrons, Classification and Linear Separability X-OR problem, Hopfield Networks, Overview of Neural Networks Architectures-Multilayered feed forward and Recurrent Networks, Learning-Supervised, Unsupervised and Reinforcement, Generalised Delta Rule.

Unit II

Multilayered Networks: Backpropagation (BP) Networks, BP Training Algorithm and Derivation for Adaption of weight, variations in Back propagation and Alternative cost function, Radial Basis function (RBF) Networks, Applications of BP and RBF Networks.

Unit III

Recurrent Networks and Unsupervised Learning : Counter Back propagation Networks, Boltzman Machine, Unsupervised learning methods, Hebbian learning Kohonen's Self Organizing feature maps, Adaptive Resonance Theory.

Unit IV

Associative Memories: Matrix, Auto, Hetero and Bidirectional Associative memories, Applications of Associative Memories. Neuro Fuzzy System: Relevance of Integration between Fuzzy Sets and Neural Networks-pros and cons, Fuzzy Neurons, Fuzzy Neuro Controllers.

Unit V

Neuro Computation : Domains of Application of Neural Networks – Expert System & Decision Making system, Pattern Recognition, Neuro Controllers and Fuzzy Neuro Controllers.

Text/References:

1. B. Yagnanarayana, Artificial Neural Networks, PHI, 2009.
2. S. Haykin, Neural Network: A Comprehensive Introduction, PHI, 2nd Edn, 1999.
1. Limin Fu, Neural Networks in Computer Intelligence, McGraw Hill International, 1994
2. John Hertz, Anders Krogh and Richard G. Palmer, Introduction to the Theory of Neural Computations, Addison Wesley, 1991
3. Yoh-Han Pao, Adaptive Pattern Recognition and Neural Networks, Addison Wesley 1989.
4. Mohammad Hassoun, Fundamentals of Artificial Neural Networks, PHI, New Delhi, 1998.

MS 304: Elective – I

MS 304: Elective – I	a) Advanced Operating System b) Computer Vision c) Advanced Computer Architecture and Parallel Computing d) Operations Research e) VLSI Design f) Natural language Processing g) Distributed Data Base Systems

MS 304: Elective – I (a) Advanced Operating System

Unit I

Process Synchronization: Concepts of processes, Concurrent processes, Threads, Overview of different classical synchronization problems, Monitors, Communicating Sequential processes (CSP)
Process deadlocks: Introduction, causes of deadlocks, Deadlock handling strategies, Models of deadlock

Unit II
Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport's Algorithm, Ricart-Agrawala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system
Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing

Unit III
Distributed OS Implementation: Models, Naming, Process migration, Remote Procedure Calls
Multiprocessor System: Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization.

Unit IV
Performance, Coprocessors, RISC & data flow: Introduction, Necessity, Measures, Techniques, Bottlenecks & Saturation, Feedback loops, Coprocessors, RISC.
Analytic Modeling: Introductions, Queing Theory, Markov Process

Unit V
Security & Protection: Security-threats & goals, Penetration attempts, Security Policies & mechanisms, Authentication, Protections & access control Formal models of protection, Cryptography, worms & viruses.

Text / Reference Books:

1. Milan Milenkovic, Operating Systems: Concepts & design, TMH, 1987.
2. H. M. Deitel, Operating System, Prentice Hall, 2004.
3. Mukesh Singhal and Niranjan G. Shivaratri, Advanced Concepts in Operating Systems, TMH, 2001.

MS 304: Elective – I (b) Computer Vision

Unit I
Introduction: What is computer vision? The Marr paradigm and scene reconstruction. Other paradigms for image analysis. Image Formation. Image Geometry. Radiometry. Digitization

Unit II
Binary Image Analysis and Segmentation: Properties. Digital geometry. Segmentation.

Unit III
Image Processing for Feature: Detection and Image Synthesis. Edge detection, corner detection, Line and curve detection, SIFT operator, Image-based modeling and rendering, Mosaics, snakes

Unit IV

Stereo. Shape from X. Shape from shading. Photometric stereo. Texture. Occluding contour detection. Motion Analysis: Motion detection and optical flow. Structure from motion.

Unit V
Object Recognition: Model-based methods, Appearance-based methods, Invariants

Text Books:

1. D. A. Forsyth and J. Ponce, Computer Vision: A Modern Approach, Prentice Hall, 2003.

References:

1. Shapiro, L. & Stockman, Computer Vision, G. Prentice Hall, 2001.
2. Trucco & Verri, Introductory technique for 3D computer vision, Prentice-Hall, 1998.

MS 304: Elective – I (c) Advanced Computer Architecture and Parallel Computing

Unit I
Advanced Computer Architecture: Introduction to Parallel Processing, Parallel Computer Structures, Pipeline and Array Computers, Multiprocessor Systems, Architectural Classification Scheme.
Interconnection network: Tree, Diamond Network, Mesh, Linear array, Ring, Star, Hypercube, Choral ring, Cube- connected cycles, perfect shuffle network, Torus, PM 21, Butterfly, Mesh of tree, Pyramid, Generalized Hyperbus, Twisted cube, Folded Hypercube, Incomplete Hypercube, Enhanced Incomplete Hypercube, Cross Connection Cube, Banyan Hypercube. Amdahl's Law, Gustafson's Law.

Unit II
Principles of pipeline and Vector-Processing, Multification and Array Pipelines, Design of Pipelined Processors, Data buffering and busing System, Vector Processing Requirements, Pipeline Computers and Vectorization Methods, Architecture of Typical Vector Processors, Vectorization and Optimization Methods.
Structures and Algorithms for Array Processors, SIMD Array Processors, SIMD Interconnection Networks, Typical Parallel Processors, Multiprocessor Architecture, Loosely and tightly coupled Multiprocessor.

Unit III
Principles of Parallel Computing: Message Passing Parallel Programming, PVM and MPI, Introduction to Pipelined Computations, Parallel Computation Models: PRAM, CRCW, CREW, EREW, Simulating CRCW on CREW & EREW. PRAM Algorithms: List Ranking, Parallel Prefix on a list, Finding Roots of trees in a Forest, Maximum of an Array, etc.

Unit IV
Parallel Sorting: Odd – Even transportation sort on Linear Array, Merge Splitting sorting, Quick Sort, Theorem of Odd-Even Merging, Zero- One Principle, Bitonic Sort. Matrix Multiplication: Sequential Matrix Multiplication: Row wise Block – Striped Parallel Algorithm, Cannon's Algorithm,

Unit V
Parallel Search Algorithms: Parallel Depth First Search, Parallel Breadth First Search, Parallel Branch and Bound Search, Parallel Best-First Search. Not smaller-than search, Distributed Real Time System, Data Flow Computer Architecture, Reduced Instruction Set Computer and Architecture Characteristics.

Text Books/References:

1. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 1989.
2. K. Hwang, Super Computer Design and Application, Computer Society Press, 1984.

3. Kai Hwang, Advanced Computer Architecture – Parallelism, Scalability, Programmability, McGraw Hill Inc., 1993
4. V. Rajaraman, Elements of Parallel Computing, PHI, 1990.
5. Barry Wilkinson and Michael Allen, Parallel Programming: Techniques and Applications using Networked Workstations and Parallel Computers, 2nd Edition, Pearson Education, 2005.
6. Ananth Grama, Introduction to Parallel Computing, 2nd Edition, Addison-Wesley, 2003
7. M. J. Quinn, Parallel Programming in C with MPI and Open MP, Tata McGraw Hill, 2003.

MS 304: Elective – I (d) Operations Research

Unit I

Introduction, convexity and related results, linear programming problem, Solution by Graphical and Simplex method. Theory of simplex method, optimality condition, Duality, Fundamental Theorem of duality.

Unit II

Study of transportation Problem – Method for finding initial solutions (North-west corner method, Least cost method, Vogel's Approximation Method), Modi method for optimum solution, Assignment problems-Mathematical formulation and solutions of assignment problems, Hurgerian method, Variations of Assignment problems, traveling salesman problem.

Unit III

Revised Simplex method, Sensitivity Analysis, Integer programming formulation- types of integer programming, concepts of a cutting plane, Gomory's all integer cutting plane method, Gomory's mixed integer cutting plane method, Branch and bound technique.

Unit IV

Introduction to game theory, Maximum-minimum Principle, games without saddle point, reduction to LPP, Networks Scheduling by PERT and CPM, Critical path analysis. Resource Analysis in Network Scheduling, Project cost, Time cost Optimization algorithm, Probability in PERT Analysis.

Unit V

Queuing Theory, Essential features of Queuing system, Operating characteristics of Queuing system, Probability Distribution in Queuing system, Classification of Queuing models, M/M/T etc. Sequencing problem: Introduction, Processing n jobs through m machines, Processing two jobs through m machines.

Text Books/References:

1. J.Medhi, Stochstic Process, New Age International Publisher, 1984.
2. H.M. Wagner, Principles of Operations Research, PHI, 1975.
3. H.A.Taha, Operations Research: An Introduction, PHI, 2004.
4. S. I. Gass, Linear programming: Methods and Applications, 5th Edition, Dover Publications, 2003.
5. J.K.Sharma, Operation Research: Theory and Applications, 4th Edition, Mcmillan, 2009.
6. W Feller, An introduction to Probability theory & its applications, 3rd Ed., Wiley Eastern, 1978.
7. M.R. Spiegel, Probability and Statistics, Schaum series, Mcgraw Hill, 2000.
8. C.W.Chrchman & EL Arnchoff : Introduction to Operation Research, Wiley and Sons, 1957.
9. E.Gillett : Introduction to Operations Research, Tata McGraw Hill, 1976.
10. D.Gross *et al.*, Fundamentals of Queuing theory, John Wiley and Sons, 2008.

MS 304: Elective – I (e) VLSI Design

Unit I

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies-Oxidation, Lithography, Diffusion, Ion implantation, Metallisation, Encapsulation, Probe testing, Integrated Resistors and Capacitors.

Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit □o; Pa
Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Unit II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 □m C
CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

Unit III

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations - □□ Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out, Choice of layers

Unit IV

Subsystem Design: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters, High Density Memory Elements.

Semiconductor Integrated Circuit Design: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach.

Unit V

VHDL Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools, Test Principles.

CMOS Testing : CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques, System-level Test Techniques, Layout Design for improved Testability.

TextBooks:

1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, Essentials of VLSI circuits and systems, PHI, 2005.
2. Weste and Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 1999.

References:

1. John P. Uyemura, Chip Design for Submicron VLSI: CMOS Layout & Simulation, Thomson Learning, 2006.
2. John .P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley, 2003.
3. John M. Rabaey, Digital Integrated Circuits, PHI, EEE, 1997.
4. Wayne Wolf, Modern VLSI Design, Pearson Education, 3rd Edition, 1997.
5. S. M. SZE, VLSI Technology, 2nd Edition, TMH, 2003.

MS 304: Elective – I (f) Natural language Processing

Unit I

Introduction to NLP, Linguistic Background:An outline of English syntax, Grammars and sentence structure , Regular Expressions, Formal Languages,Finite State Automata, Non deterministic Finite State Automata(NFSA),Using an NFSA to accept strings, Relating deterministic and non deterministic FSA, Elementary probability theory and entropy.

Unit II

Morpholgy & Finite State Transducers: Survey of (mostly) English morphology,Inflectional morphology, derivational morphology, Introduction to shallow parsing and morphological analyzer:Rule based POS tagger, Stochastic POS tagger ,Chunking, Use of Morphological analyzer in POS tagging.

Unit III

Introduction to HMM Tagger:HMM for POS tagging,Viterbi algorithm,
, Parsing: Top Down Parsing, Bottom up Parsing, Earley Parsing, and Finite-State Parsing Methods.

Unit IV

Application of Bayes Theorem in Statistical NLP – (Spell Checker as a case study), Collocations,
Probabilistic Context Free Grammar (PCFG), finding the most likely parse for a sentence, Training a PCFG

Unit V

Introduction to Word Sense Disambiguation: Supervised Disambiguation, Dictionary based disambiguation, Unsupervised disambiguation, clustering in statistical NLP

Text Books/References:

1. James Allan, Natural Language Understanding, Pearson Education, 1995.
2. Jurafsky and Martin, Speech and Language Processing, Pearson Education, 2000.
3. Manning and Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.
4. Bharati *et al*., Natural Language Processing, PHI, 1996

MS 304: Elective – I (g) Distributed Data Base Systems

Unit I

Distributed DBMS features and needs. Reference architecture. Levels of distribution transparency, replication. Distributed database design - fragmentation, allocation criteria.

Unit II

Storage mechanisms. Translation of global queries. / Global query optimisation. Query execution and access plan. Concurrency control - 2 phases locks. Distributed deadlocks. Time based and quorum based protocols. Comparison. Reliability- non-blocking commitment protocols.

Unit III

Partitioned networks. Checkpoints and cold starts. Management of distributed transactions- 2 phase unit protocols. Architectural aspects. Node and link failure recoveries.

Unit IV

Distributed data dictionary management. Distributed database administration. Heterogeneous databases-federated database, reference architecture, loosely and tightly coupled.

Unit V

Alternative architecture. Development tasks, Operation- global task management. Client server databases-SQL server, open database connectivity. Constructing an application.

Text Books:

1. Silberschatz, Korth, Sudarshan, Database System Concepts, McGraw Hill Education, 2010.
2. Ceri & Pelagatti, Distributed Databases: *Principles and Systems*, TMH, 1984.
3. Ozsu & Patrick, Principles of Distributed Database Systems, Pearson Education, 2006.
4. R. Elmasri & S. B. Navathe, Fundamentals of Database System, Pearson Education, 2008.

References:

1. Ramakrishnan, Database Management Systems, McGraw Hill Higher Education, 2003.
2. Vieira, Beginning SQL Server 2005 programming, John Wiley and Sons, 2006.
3. A. Leon and M. Leon, Database Management Systems, VIKAS, 2008.

MS 305: Laboratory – 3

(a) Practical on Data Ware Housing and Data Mining
(b) Practical on Artificial Neural Network and Expert Systems

(a) **Practical on Data Ware Housing and Data Mining**

Problems and various algorithms related to Data Ware Housing and Data Mining should be solved and implemented by using the Programming languages C/C++/JAVA/VB as well as various tools for Data Ware Housing and Data Mining.

(b) **Practical on Neural Network and Expert Systems**

Problems related to Neural Network and Expert Systems should be solved by using the Programming languages C/C++/JAVA as well as various tools for Neural Network and Expert Systems.

Semester IV

MS 401: Distributed Computing

Unit I

Fundamentals: Introduction, Models and Features, Concept of distributed operating system, Issues in design of a distributed operating system. Client Server Computing
Message Passing: Good message passing system, IPC, Synchronization, Buffering, Multi datagram messages, Encoding & decoding techniques, Process addressing, Failure handling, Group communication; Remote procedure calls (RPC) - Models, Communication protocols, RPC, Lightweight RPC.

Unit II

Distributed Shared Memory: Architecture, Thrashing, Granularity, Advantages
Synchronization: Introduction, Clock Synchronization, Event handling, Mutual Exclusion; Deadlock – Conditions, Avoidance, Prevention, Recovery.

Unit III

Resource & process Management: Features of a good scheduling algorithm, Task assignment approach, Load balancing & load sharing approach, Introduction to process management, Process migration, Threads.

Unit IV
Distributed Files Systems: Introduction, Features, Models, Accessing models; sharing Semantics & caching schemes, replication, Fault Tolerance, Atomic transactions. Distributed File Servers, Distributed Real Time System

Unit V
Distributed Database, Concurrency Control in Distributed Database, Naming: Introduction, Features, Fundamental Terminologies & concepts, System oriented names, Human oriented names, Name caches.
Security: Potential attacks to computer system, Cryptography, Authentication, digital signatures, Access Control.

Text Books:

1. Sinha Pradeep K., Distributed operating Systems, Concepts & design, PHI, 1998.
2. Tanenbaum Andrews S., Distributed Operating System, Pearson, 1995.

References:

1. Coulouris George, Dollimore Jean, Kindberg Tim, Distributed Systems, Concepts & design, Pearson.
2. Silberschatz, Galvin, Operating System Concepts, John Wiley, 5th Edition.

MS 402: Fuzzy Set Theory and Applications

Unit I
Introduction, Basic concepts on fuzzy sets, Fuzzy sets versus crisp sets, Properties of alpha-cuts, Representation of fuzzy sets, Extension principle, Fuzzy arithmetic – Fuzzy numbers, Arithmetic operations on fuzzy numbers.

Unit II
Operation on fuzzy sets, Fuzzy union, intersection and complement, combinations of operations, Fuzzy relations, Projections & cylindric extentions, Binary fuzzy relations, Fuzzy equivalence and compatibility relations, Fuzzy ordering relations, Fuzzy morphism.

Unit III
Fuzzy measures, Belief and possibility measures, Evidence theory, Possibility theory versus Probability theory, Fuzzy logic, Multivalued logic, Fuzzy propositions, Fuzzy qualifiers.

Unit IV
Approximate reasoning – Fuzzy expert system (an overview), Fuzzy implications, Selection of fuzzy implication, Multiconditional approximate reasoning, Fuzzy system (general discussion), Fuzzy controllers (overview and example)

Unit V
Fuzzy system & neural network, Fuzzy automata, Pattern recognition (introduction), Fuzzy clustering, Fuzzy pattern recognition, Fuzzy image processing.

Text Books/References:

1. Fuzzy set theory & application – by G. J. Klir and Folger, Kluwer Academic Publishers, 2nd Ed., 1991.
2. Fuzzy sets and Fuzzy logic theory and application – by George J. Klir and Bo Yuan, PHI pub., 1997
3. Neural Networks and Fuzzy Systems: A Dynamic Systems Approch to Machine Intelligence – by B. Kosko, PHI publication, 1997
4. Neutral Networks in Computer Intelligence – by Limin Fu, McGraw Hill International, 1994
5. Introduction to the Theory of Neural Computations – by John Hertz, Addison Wesley, 1991

MS 403: Cryptography

Unit I

Foundations of Cryptography and Security: Ciphers and Secret Messages, Security Attacks and Services.
Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic, Discrete Logarithms.

Unit II

Conventional Symmetric Encryption Algorithms: Theory of Block Cipher Design, Feistel Cipher Network Structures, DES and Triple DES, Modes of Operation (ECB, CBC, OFB, CFB), Strength (or Not) of DES.

Unit III

Modern Symmetric Encryption Algorithms: IDEA, CAST, Blowfish, Twofish, RC2, RC5, Rijndael (AES), Key Distribution.
Stream Ciphers and Pseudo Random Numbers: Pseudo random sequences, Linear Congruential Generators, Cryptographic Generators, Design of Stream Cipher, One Time Pad.

Unit IV

Public Key Cryptography: Prime Numbers and Testing for Primality, Factoring Large Numbers, RSA, Diffie-Hellman, ElGamal, Key Exchange Algorithms, Public-Key Cryptography Standards.
Hashes and Message Digests: Message Authentication, MD5, SHA, RIPEMD, HMAC.

Unit V

Digital Signatures, Certificates, User Authentication: Digital Signature Standard (DSS and DSA), Security Handshake Pitfalls, Elliptic Curve Cryptosystems.
Authentication of Systems: Kerberos V4 and V5, X.509 Authentication Service.
Digital Watermarking and Steganography

Text Books:

1. William Stallings, Cryptography and Network Security: Principles and Practice, 4th Edition, Prentice Hall Publisher, 2005.
2. Bruce Schneier, Applied Cryptography: protocols, algorithms, and source code in C, 2nd Edition, Wiley, 1996.
3. Alfred J. Menezes , Handbook of Applied Cryptography, CRC Press, 1996.
4. Michael Welschenbach , Cryptography in C and C++ , Apress, 2001.
5. Douglas R. Stinson, Cryptography: Theory and Practice, 3rd Edition, Chapman & Hall /CRC, 2005.

References:

1. William Stallings, Cryptography and Network Security, 4th.Ed, Prentice Hall PTR, Upper Saddle River, NJ, 2006
2. Wenbo Mao, Modern Cryptography: Theory and Practice, Prentice Hall, 2004
3. Richard A. Mollin, An Introduction to Cryptography, Chapman and Hall/CRC, 2001.

4. B. Schneier, Applied Cryptography, John Wiley and Sons, NY, 1996.
5. A. Menezes, P. Oorshcot, and S. Vanstone, Handbook of Applied Cryptography, CRC Press, Boca Raton, FL, 1997.
6. Thomas H. Barr, Invitation to Cryptography, Prentice Hall, 2002.
7. Richard J. Spillman, Classical and Contemporary Cryptology, Prentice Hall, 2005.

MS 404: Elective –II

MS 404: Elective – II	a) Evolutionary Computation b) Machine Learning c) Computational Geometry d) Clustering and Grid Computing e) Pattern Recognition f) Quantum Computation g) Embedded Real Time Systems h) Digital Signal Processing

MS 404: Elective – II (a) Evolutionary Computation

Unit I
Genetic algorithms - the three main genetic operators, Schema theory, Schema theorem

Unit II
The building block hypothesis, implicit parallelism, Exploration versus exploitation, Stochastic models of GAs- reliability model, branching-process model, Markov models

Unit III
Convergence analysis, Analysis of Selection, Analysis of crossover, Analysis of mutation-crossover versus mutation

Unit IV
Non-canonical GAs. Deception, Evolution strategies, Evolutionary programming, Genetic programming

Unit V
Applications of EAs in diverse field - constrained optimization, combinatorial optimization, learning
Hybrid strategies and connections to other soft computing paradigms

Text Books:

1. David E. Goldberg: Genetic Algorithms in Search, Optimization and Machine Learning, Addision Wesley, MA, 1989.

References:

1. IEEE Transactions on Evolutionary Computation
2. Evolutionary Computation, MIT Press.

MS 404: Elective – II (b) Machine Learning

Unit I
Introduction-Objectives-Taxonomy, Review Basic Tasks, Methods and underlying problems of Machine Learning

Unit II
Learning methods such as role, analogical, EBG, EBL, Chunking. Learning form Examples - Version space algorithm, Inductive Concept Learning - Sequence Prediction - Effect of Noise in Input.

Unit III
Learning by Analogy- Concept formation - Derivational Analogy, Learning by Observation and Discovery Search for Regularity-Conceptual Clustering

Unit IV
ID3 algorithm, important systems and applications to the problem of knowledge acquisition for expert system

Unit V
Computational Learning Theory, Connectionist Learning

Text Books/References:

1. Michalsky, T. Mitchell, J.Corbonell, Machine Learning Springer-Verlag
2. T. M. Mitchell. Machine Learning, McGraw-Hill, 1997
3. Michalski, Carbonnel & Michel (Eds.): Machine Learning - An A. I. Approach, Vols. I, II & III, Morgan Kaufmann
4. C. J. Thornton: Techniques in Computational Learning, Chapman & Hall Computing

MS 404: Elective – II (c) Computational Geometry

Unit I
Introduction: historical perspective, algorithmic background, geometric preliminaries, initial forays
Convex hulls, problem statement and lower bounds, convex hull algorithms, convex hulls in >2 dimensions, extensions and applications

Unit II
Polygon approximation: triangular approximations, k-gonal approximations, restricted approximations, other criteria of approximation

Unit III
Geometric searching: point-location problems, range-searching problems

Unit IV
Proximity: Typical problems and lower bounds, Closest pair problem, Voronoi diagrams, Minimum spanning trees, Triangulations

Unit V
Miscellaneous problems: (More) Art gallery problems, Intersections, Pattern recognition, Parallel computational geometry

Text Books:

1. Laszlo, Computational Geometry, PHI
2. M.de Berg, Computational Geometry-algorithms & applications, Springer India, 2008

MS 404: Elective – II (d) Clustering and Grid Computing

Unit I

Introduction: Motivation, Definitions of Grid Computing, Evolution of the Grid, Differences with similar efforts (Meta, cluster, heterogeneous, Internet), Examples of usage, scope of Grid Computing.

Unit II

The Earliest Grid Motivations: High Performance computing across installation sites - the PACX-MPI example, High Throughput computing using non-dedicated workstations – Condor.

Unit III

The Building Blocks of Grid: The Globus toolkit, Security - Kherberos vs Globus GSI, Information Services – NWS, Projects over Globus - e.g. Condor-G.

Unit IV

HPC and Grids: Scheduling HPC applications in Grids- AppLeS, Scheduling Parameter sweep applications, Metascheduling; Grid RPC mechanisms; Rescheduling.

Unit V

Advanced Topics: Data Management in Grids, Grid simulation – MicroGrid, Grid Applications, Grid economy, Grid standards and forums - OGSA, GGF and Other topics

Text Books:

1. Ian Foster, Carl Kesselman, The Grid: Blueprint for a New Computing Infrastructure (2nd ed.), 2nd edition, Morgan Kaufmann, 2003.
2. Francine Berman, Geoffrey Fox, Hey, Grid Computing: Making the Global Infrastructure a Reality by John Wiley & Sons, 2003.

References:

1. Jarek Nabrzyski, Jennifer M. Schopf, Jon Weglarz, Grid Resource Management: State of the Art and Future Trends, Kluwer Academic Publishers, 2003.
2. Ian Foster, Carl Kesselman, The Grid 2: Blueprint for a New Computing Infrastructure, Morgan Kaufmann, 2003.

MS 404: Elective – II (e) Pattern Recognition

Unit I

Introduction: Examples; The nature of statistical pattern recognition; Three learning paradigms; The sub-problems of pattern recognition; The basic structure of a pattern recognition system; Comparing classifiers.
Bayes Decision Theory: General framework; Optimal decisions; Classification; Simple performance bounds.

Unit II

Learning - Parametric Approaches: Basic statistical issues; Sources of classification error; Bias and variance; Three approaches to classification: density estimation, regression and discriminant analysis; Empirical error criteria; Optimization methods; Failure of MLE;

Parametric Discriminant Functions : Linear and quadratic discriminants; Shrinkage; Logistic classification; Generalized linear classifiers; Perceptrons; Maximum Margin; Error Correcting Codes;

Unit III

Error Assessment: Sample error and true error; Error rate estimation; Confidence intervals; Resampling methods; Regularization; Model selection; Minimum description length; Comparing classifiers
Nonparametric Classification: Histograms rules; Nearest neighbor methods; Kernel approaches; Local polynomial fitting; Flexible metrics; Automatic kernels methods

Unit IV

Feature Extraction: Optimal features; Optimal linear transformations; Linear and nonlinear principal components; Feature subset selection; Feature Extraction and classification stages, Unsupervised learning and clustering, Syntactic pattern recognition, Fuzzy set Theoretic approach to PR,

Unit V

Margins and Kernel Based Algorithms: Advanced algorithms based on the notions of margins and kernels
Applications of PR: Speech and speaker recognition, Character recognition, Scene analysis.

Text Book:

1. Theodoridis & Koutroumbas, Pattern Recognition, 4th Edition, Academic Press, 2008.

MS 404: Elective – II (f) Quantum Computation

Unit I

Introduction to Quantum Computation, Concept and Fundamental Properties of Cbits and Qbits - Cbits and their states, Reversible Operations on Cbits, Qbits and their states. Reversible Operations on Qbits. The measurement of Qbits, Table: Cbits vs. Qbits Further Features of Dirac Notation. Structure of the general 1-Qbit unitary transformation Structure of the general 1-Qbit state. An application of the formalism: \Spooky action at a distance", A General Remark about the Figures

Unit II

Quantum Computation: General features and some simple examples, The general computational process, Deutsch's Problem; Why additional subroutine Qbits needn't mess things up; Some more substantial speed-ups with a quantum computer: Bernstein-Vazirani problem; Simon's problem.The importance of cNOT gates

Unit III

Breaking RSA Encryption with a Quantum Computer: Shor's Factoring Algorithm, Number theoretic preliminaries, RSA encryption, Quantum period-finding: setting things up, The Quantum Fourier Transform, Calculating the periodic function, The unimportance of unavoidable small phase errors, Period finding and factoring

Unit IV

Searching with a Quantum Computer The Grover iteration, How to construct W, Generalization to several special numbers. Quantum Error Correction.A simplified example of quantum error correction.The physics of error generation, Diagnosing error syndromes.Error correcting codes, The 7-Qbit code, Circuits that make the 7- and 5-Qbit codewords.

Unit IV

Quantum cryptography and some simple uses of entanglement, Quantum cryptography, Bit commitment, Quantum dense coding, Teleportation, The GHZ state.

MS 404: Elective – II (g) Embedded Real Time Systems

Unit I

Introduction: Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RT-level), custom single purpose processor design (RT-level), optimizing custom single purpose processors.
General purpose processors: Basic architecture, operation, Pipelining, Programmer's view, development environment, Application Specific Instruction-Set Processors (ASIPs) – Micro Controllers and Digital Signal Processors.

Unit II

State Machine And Concurrent Process Models: Introduction, models Vs. languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model, real-time systems.

Unit III

Communication Interface: Need for communication interfaces, RS232 / UART, RS422 / RS485, USB, Infrared, IEEE 1394 Firewire, Ethernet, IEEE 802.11, Blue tooth.

Unit IV

Embedded / RTOS Concepts – I: Architecture of the Kernel, Tasks and Task scheduler, Interrupt service routines, Semaphores, Mutex. Mailboxes, Message Queues, Event Registers, Pipes, Signals
Timers, Memory Management, Priority inversion problem, Embedded operating systems Embedded Linux, Real-time operating systems, RT Linux, Handheld operating systems, Windows CE.

Unit V

Design technology: Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis,
Logic Synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hardware/ Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.

Text Books:

1. Frank Vahid, Tony D. Givargis, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley, 2002.
2. KVKK Prasad, Embedded / Real Time Systems, Dreamtech Press, 2005.

References:

1. Jonathan W. Valvano, Embedded Microcomputer Systems, Brooks / Cole, 2000.
2. David E. Simon, An Embedded Software Primer, Pearson Ed., 2005.
3. Raj Kamal, Introduction to Embedded Systems, TMS, 2002.

4 Sri Ram V Iyer, Pankaj Gupta, Embedded Real Time Systems Programming, TMH, 2004.

MS 404: Elective – II (h) Digital Signal Processing

Unit I

Introduction, Overview of digital signal processing

Review of: Discrete – Time linear system, Sequences, arbitrary sequences, linear time invariant system, causality, stability. Difference equation, relation between continuous and discrete system, Classifications of sequence, recursive and non-recursive system

Review of: Mathematical operations on sequences: Convolution, graphical and analytical techniques, overlap and add methods, matrix method, some examples and solutions of LTI systems, MATLAB examples.

Unit II

Z-transform: Definition, relation between Z transform and Fourier transform of a sequence, properties of Z transform, mapping between S-plane and Z-plane. Unit circle, convergence and ROC, Inverse Z-transform, solution of difference equation using the one sided Z-transform MATLAB examples.

Unit III

Discrete Fourier transform: Definition, inverse discrete Fourier transform (IDFT) Twiddle factor, linear transformation, basic properties, circular convolution, multiplication of DFT, linear filtering using DFT, filtering of long data sequences, overlap add and save method. Computation of DFT, Fast Fourier transform (FFT), FFT algorithm, Radix 2 algorithm. Decimation-in-time and decimation-in- frequency algorithm, signal flow graph, butterflies, Chirp z-transform algorithm, MATLAB examples

Unit IV & V

Digital filter realization: Principle of digital filter realization, structures of All-zero filters. Design of FIR (Finite impulse response) filters, linear phase, windows-rectangular, Berlitt, Hanning, Hamming and Blackman. Design of infinite impulse response filters (IIR) from analog filters. Bilinear transformation, Butterworth, Chebyshev, Elliptic filters. Optimisation method of IIR filters. Some example of practical filter design. Computer aided filter design, MATLAB examples

Text Books:

1. Ifeachor, Digital Signal Processing, Pearson, 2nd Edition, 2002.
2. R. G. Lyons, Understanding Digital Signal Processing, Prentice Hall, 2010
3. L.R. Rabiner & B.Gold, Theory and Application of Digital Signal Processing, PHI, 2009.
4. J.G. Proakis & D.G. Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, PHI , 2008.
5. S. Salivahanan et al., Digital Signal Processing, TMH

References:

1. Chen, Digital Signal Processing, OUP
2. Meyer-Basse U, Digital Signal Processing with FPGA, Spriger India, 2007.
3. Ingle, Digital Signal Processing using MATLAB, Vikas Publishing House, 2001.
4. Babu R, Digital Signal Processing, Scitech Publications, 2010.
5. S. K. Mitra, Digital Signal Processing - A Computer based approach, TMH, 2006.
6. Xavier, Digital Signal Processing, S. Chand, 2003
7. Pradhan, Digital Signal Processing Applications, Jaico

MS 405: Laboratory – 10: Project work

The Project gives an opportunity to the student to use the methodologies/techniques taught in several courses in the curriculum. The topics for the project to be undertaken by the department, after deliberations among the faculty members, shall be notified to the students. The project is to be carried out under the guidance of a faculty member of the department. A student should submit 3 copies of dissertation for evaluation at the end of the semester and present his project as a seminar topic. The external examiner in consultation with the internal examiner shall carry out the adjudication, after giving due weightage to the work carried out in the project, the presentation of the project, and viva voice. The guide/supervisor will be the internal examiner and external shall be appointed from a panel of examiners.

Marks Distribution:

Internal Assessment:	25 marks
Dissertation:	50 marks
Presentation and Viva Voce:	25 marks
Total:	100 marks