Master of Computer Science and Engineering

FIRST SEMESTER

Theoretical Courses	Subjects		Periods/Weeks		Marks		Credit Points
Departmental / Specialization Basket	Subject Code	Subject Name	Lecture	Sessional	Examination	Sessional	
Paper-I	PG / CSE / T / 111A	Theory of Computing	3		100		3
Paper-II	PG / CSE / T/ 112A	Advanced Algorithms	3		100		3
Paper-III	PG / CSE / T/ 113A	High Performance Architecture	3		100		3
	PG / CSE / T/ 113B	Advanced Operating Systems					
Note: The students have to select 3 subjects from the departmental/ specialization basket, i.e. one subject each from the list given in the baskets of Paper-I, Paper-II and Paper-III							
Inter-Disciplinary Basket	Subject Code	Subject Name	Lecture	Sessional	Examination	Sessional	
Paper-IV	PG / CSE / T/ 114A	Advances in Artificial Intelligence	3		100		3
	PG / CSE / T/ 114B	Embedded & Real-time Systems					
	PG / CSE / T/ 114C	Computer Communication Network					
	PG / CSE / T/ 114D	Advanced Database System Concepts					
Paper-V	PG / CSE / T/ 115A	Object oriented Design & Techniques	3		100		3
	PG / CSE / T/ 115B	VLSI System Design					
	PG / CSE / T/ 115C	Wireless Communication & Mobile Computing					
	PG / CSE / T/ 115D	Machine Learning					
Paper-VI	PG / CSE/ T / 116A	Image Processing	3		100		3
	PG / CSE / T / 116B	Modeling and Simulation					
	PG / CSE / T / 116C	Information and Coding Theory					
Note: The students have to select 3 subjects from the inter-departmental basket, i.e. one subject each from the list given in the baskets of Paper-IV, Paper-V and Paper-VI							

Sessional Courses							
Sessional 1	PG / CSE / S / 111	Assignment		4		100	3
Sessional 2	PG / CSE / S / 112	Seminar		3		100	3
			18	**7**	**600**	**200**	**24**

Total Periods/Week = 25 **Total Marks = 800**

SECOND SEMESTER

Theoretical Courses	Subjects		Periods/Weeks		Marks		Credit Points
Departmental / Specialization Basket	Subject Code	Subject Name	Lecture	Sessional	Examination	Sessional	
Paper-VII	PG / CSE / T/ 127A	Distributed Operating Systems	3		100		3
	PG / CSE / T/ 127B	Distributed Systems					
	PG / CSE / T/ 127C	Pattern Recognition					
	PG / CSE / T/ 127D	Computational Geometry					
Paper-VIII	PG / CSE / T/ 128A	Complexity of Computation	3		100		3
	PG / CSE / T/ 128B	Information Security					
	PG / CSE / T/ 128C	Soft Computing					
	PG / CSE / T/ 128D	Software Engineering					
	PG / CSE / T/ 128E	High Speed Networking					
Paper-IX	PG / CSE / T/ 129A	Combinatorial Algorithm	3		100		3
	PG / CSE / T/ 129B	Natural Language Processing					
	PG / CSE / T/ 129C	Data Warehousing & Data Mining					
	PG / CSE / T/ 129D	VLSI Testing & Verification					
	PG / CSE / T/ 129E	Cryptography					

Note: The students have to select 3 subjects from the departmental/ specialization basket, i.e. one subject each from the list given in the baskets of Paper-VII, Paper-VIII and Paper-IX

Inter-Disciplinary Basket	Subject Code	Subject Name	Lecture	Sessional	Examination	Sessional	
Paper-X	PG / CSE / T/ 1210A	Service Oriented Architecture	3		100		3
	PG / CSE / T/ 1210B	Multimedia Technologies					
	PG / CSE / T/ 1210C	Network Security					
	PG / CSE / T/ 1210D	Parallel Computing Techniques					
	PG / CSE / T/ 1210E	Bioinformatics					
Note: The students have the freedom to choose one subject from the list under Paper-X.							
Sessional Courses							
Sessional 1	PG / CSE / S / 121	Term Paper Leading to Thesis		3		100	3
Sessional 2	PG / CSE / S / 122	Seminar		3		100	3
			12	**6**	**400**	**200**	**18**

Total Periods/Week = 18 Total Marks = 600

THIRD and FOURTH SEMESTER

Courses							
1	PG / CSE / TH / 21	Thesis Work		16		300	12
2	PG / CSE / VV/ 22	Viva-Voce on Thesis				100	
				16		**400**	**12**

Total Periods/Week = 16 Total Marks = 400

SYLLABUS OF MASTER OF COMPUTER SCIENCE AND ENGINEERING

First Semester

Category - Departmental / Specialization Basket

Paper- I

PG / CSE / T / 111A Theory of Computing

Optimization and decision problems, Reductions, Turing Machine as an acceptor and as an enumerator—Techniques of Turing Machine construction – parallel tracks and storage in control, subroutine Turing Machine, Church-Turing thesis, Variants of Turing Machine – multitape, nondeterministic—their equivalences with other models. Properties of recursively enumerable and recursive sets. Relations between unrestricted grammars and Turing Machines. Linear Bounded Automata —relation with Context Sensitive Languages Enumeration of Turing Machines, existence of undecidable problems, Undecidable problems involving Turing Machines and CFG's. Universal Turing Machine as a model of general purpose computer, Post Correspondence Problem – Applications, valid and invalid computations of Turing Machines. Time and Space complexity of Turing Machines, NP-completeness.

References:

1. John C. Martin: Introduction to languages and the theory of computation, 2nd Ed., McGraw Hill.
2. D.P. Bovet & P. Gescenzi: Introduction to Theory of Complexity, PH.
3. Rozenberg & Salomaa: Handbook of Formal languages, Vol. I&II.

Paper- II

PG / CSE / T / 112A Advanced Algorithms

Algorithmic paradigms: Median and order statistics, Advanced data structures, Dynamic Programming, Greedy, Branch-and-bound; Asymptotic complexity, Amortized analysis; Graph Algorithms: Shortest paths, Flow networks; NP-completeness; Approximation algorithms; Randomized algorithms; Linear programming; Special topics: Geometric algorithms (range searching, convex hulls, segment intersections, closest pairs), Numerical algorithms (integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations), Internet algorithms (text pattern matching, tries, information retrieval, data compression, Web caching).

References:

1. T. Cormen, C. Leiserson, R. Rivest, and C. Stein. Introduction to Algorithms (2nd edition). MIT Press / McGraw-Hill
2. Michael T. Goodrich and Roberto Tamassia. Algorithm Design: Foundations, Analysis, and Internet Examples. John Wiley & Sons
3. J. Kleinberg and É. Tardos. Algorithm Design. Addison-Wesley, 2005

Paper- III

PG / CSE / T / 113A High Performance Architecture

Introduction: review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. CISC and RISC processors.
Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques. Compiler techniques for improving performance.
Hierarchical memory technology: Inclusion, Locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.
Instruction-level parallelism: basic concepts, techniques for increasing ILP, dynamic scheduling (Tomasulo's Algorithm), reorder buffer and instruction commit, branch prediction and advanced instruction delivery, speculative execution. Superscalar, super-pipelined and VLIW processor architectures.
Array and vector processors. Multiprocessor architecture: taxonomy of parallel architectures. Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Model of memory consistency, cache coherency, multiprocessing snooping protocol, multiprocessing directory protocol. Cluster computers.
Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.
Multicore Arcitecture.

References:

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.
2. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill.
3. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.
4. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.

PG / CSE / T / 113B Advanced Operating Systems

OS kernel structures – microkernel, monolithic kernel – characteristics and privileged operations. Process Synchronization Management – synchronization tools like monitor and others with implementation in any two OS. Process and thread management, especially on multicore processors. Threads, Events and Scheduling. Interprocess Communication – Remote Processor Call – overview and implementation. Device Drivers – Concepts, Design and Implementation. Advanced File Systems – Caching, Examples: Unix FFS, Log-based File System. Single Address space system – Opal. Operating System organization. Distributed Shared Memory. Real-time OS – Characteristics an example. Advanced and recent topics in Operating Systems (from International Journal, Proceedings of International Conferences). Detailed Case Studies: Unix, Linux, Open Solaris, Windows NT/XP (at least any two).

References:

1. M. Singhal, N. Shivaratri, Advanced Concepts in Operating Systems, McGraw-Hill, 1994.
2. W. Stallings, Operating Systems - Internals and Design Principles, Prentice Hall, 1998.
3. W. Stallings, Operating Systems, Macmillian Publishing, 1992.
4. K. Raymond, A Tree-Based Algorithm for Distributed Mutual Exclusion, *ACM Transactions on Computer Systems*, Vol. 7, No. 1, February 1989, pp 61-77.
5. M. Seltzer, K. Bostic, K. Mckuisick, C. Stailin, An implementation of a Log-structured file system for Unix, Proc. of Winter USENIX, 1993.
6. M. K. Mckuisick, W. N. Joy, S. J. Lefer, R.S.Fabry, A Fast File System for Unix
7. B. N. Bershad, E. D. Lazowska, H. M. Levy, Scheduler Activations: Effective Kernel support for user-level management of parallelism, T.E. Anderson, *ACM Transactions on Computer Systems*, Vol. 10, No. 1, February 1992, pp 53-79
8. J. Chase, H. Levy, M.B. Harvey, E. Lazowska, Opal: A Single Address Space System for 64-bit Architectures

Category – Inter - Disciplinary Basket

Paper- IV

PG / CSE / T/ 114A Advances in Artificial Intelligence

Introduction, Major approaches to AI (viz., symbol Processing & Subsymbolic approaches), A brief introduction to connectionist approach, Subsumption architecture and Evolutionary approach under subsymbolic approaches, Major subfields of AI, Intelligent search(viz., state space search, Algorithm A*, GA etc.), Knowledge representation through predicate calculus, resolution reputation system, reasoning using Horn clauses, case based reasoning, reasoning with uncertain information (viz., Probabilistic inference, Bayes networks,default reasoning, D-S theory, Fuzzy sets and fuzzy logic, Learning Bayes networks, Machine Learning: a brief introduction, Neural networks, Intelligent agents.

References:

1. E.Rich,K.Knight: Artificial Intelligence,2nd Ed, Tata Mc Graw Hill.
2. D.W.Patterson: Introduction to Artificial Intelligence & Expert systems,PHI,1990.
3. M.Ginsberg:Essentials of A.I.,Morgan Kaufmann.

PG / CSE / T/ 114B Embedded & Real-time Systems

Introduction to Embedded Systems: Architecture of Embedded Systems - Hardware Architecture, Software Architecture, Communication Software, Development/Testing Tools.

Programming for Embedded Systems: The Process of Embedded System Development - Design Trade offs, Hardware Software co-design, Implementation, Integration and Testing. Hardware Platforms. Communication Interfaces.

Embedded/Real-time Operating Systems Concepts - Representative Embedded Systems, Suitability and Characteristics of operating systems for RT applications. Programming in RT-Linux. RT Rule based Expert System. Embedded Database Application. Mobile Java

Applications: Embedded Software Development on 8051 Micro-controller Platform DSP-based Embedded Systems - Implementation of Embedded Systems with VHDL, FPGA and CPLD. Embedded Systems Applications using Strong ARM Platform

References:

1. Embedded/Real-time Systems: Concepts, Design and Programming – Dr. K.V.K.K. Prasad, Dreamtech press.
2. Programming for Embedded Systems – Dreamtech Software team, Willey - dreamtech
3. Real time systems - Jane Liu, Prentice Hall
4. Real-Time Systems: Scheduling, Analysis, and Verification - by Prof. Albert M. K. Cheng, John Wiley and Sons

PG / CSE / T/ 114C Computer Communication Network

Review of data communication principles: communication fundamentals, signals and channel characteristics, line codes, modulation and Modem, repeaters/equalizers, asynchronous/synchronous/intermittently synchronous data communication; data transparency; error detection and correction techniques principle of CRC; stop-and-wait protocol and its efficiency analysis.
Review of point-to-point channel sharing techniques: FDM, TDM and TDM hierarchy; polling and concentration; spread spectrum communication and CDMA.
Network structure and architecture: concept of communication subnet and its 2-level hierarchy; network architecture and OSI architectural reference model.
Network Layer: Connectionless and connection-oriented services; datagram and V.C subnet organization; routing techniques static multipath; isolated/centralized/distributed dynamic, DVR, LS, hierarchical and multidestination; congestion avoidance and control.
Local area networks (LANS): IEEE standards and protocol layers, Ethernet and token ring LAN-architecture, protocol management.
LAN Internetworking: Principle, relaying devices- bridges and switches, transparent and source routing bridges.
TCP/IP and the global Internet: Architecture and protocol layer of the global Internet, IPv4 protocol format, IP addresses-classful and classless, IP address management-subnetting, proxy ARP and DHCP, datagram forwarding, routing in the Internet, intra-domain and inter domain protocols, IPv6, Transport layer protocols and addressing, NAT box. An overview of network security.

References:

1. W.Stallings:Data and Computer Communication,5th Ed., PHI,1998.
2. D.Bertsekas and R. Gallagher: Data Networds, 2nd Ed.,PHI,1992.
3. A.Tanenbaum: Computer Networks, 2nd Ed., PHI,1998.
4. F.Halshall: Data Communication, Computer Network and Open Systems, 3rd Ed, Addison Wesley, 1992.
5. D.Russel: The Principles of Computer Networking, Cambridge University Press,1989.
6. M.Schwartz: Computer Communication Network Design and Analysis, PHI,1977
7. L.Klienrock: Queuing Systems, Vol I, Wiley, 1976.
8. G.E.Keiser: Local Area Network, McGraw Hill. 1989.

PG / CSE / T/ 114D Advanced Database System Concepts

Relational Database Management Issues - Transaction Processing, Concurrency, Recovery, Security and Integrity.
Distributed Databases - Storage structures for distributed data, data fragmentation, Transparency of distributed architecture, Distributed query processing, Transaction management in distributed environment, Recovery and Concurrency control, Locking protocols, Deadlock handling, Dynamic modeling of distributed databases, Client - Server Databases. Performance Tuning, Advanced Transaction Processing.
Object-oriented Databases - Objects and Types, Specifying the behavior of objects, Implementing Relationships, Inheritance. Sample Systems. New Database Applications.
Multimedia Database - Multimedia and Object Oriented Databases, Basic features of Multimedia data management, Data Compression Techniques, Integrating conventional DBMSs with IR and Hierarchical Storage Systems, Graph Oriented Data Model, Management of Hypertext Data, Client Server Architectures for Multimedia Databases,

References:

1. H.F.Korth & A. Silverschatz: Database Systems Concepts, McGraw Hill.
2. Bindu R.Rao: Object Oriented Databases, McGraw Hill, 1994.
3. Gray, Kulkarni, Paton: Object Oriented Databases, Prentice Hall International, 1992.
4. Khoshafian: Object Oriented Databases, John Wiley & Sons,1993.
5. S. Khoshafian & A.B. Baker, Multimedia and Imaging Databases,Morgan Kaufmann Publishers, 1996.
6. Kemper & Moerkoette: Object-Oriented Database Management, PH, 1994.
7. Alex Berson: Client/Server Architecture, McGraw Hill.

Paper- V

PG / CSE / T/ 115A Object oriented Design & Techniques

Object Oriented Programming (OOP) - Classes, Objects, Attributes, Methods, Messages, Abstraction, Encapsulation, Modularity, Inheritance, Generitance, Exception Handling. These concepts are to be introduced with reference to the language features of C++, Smalltalk and Java. [Parsons, Winston Budd]. OO Life Cycle Models, Object Oriented Analysis (OOA), Object Oriented Design (OOD), Object Oriented Testing, Metrics for Object Oriented Systems. [Pressman, Chapters 19-23]. OMT Methodology. [Rambaugh, Chapters 3-6 and 8-10].

References:

1. G.Booch: Object Oriented Design with Applications, 1991, Benjamin/Cummings.
2. T.Budd: An Introduction to Object Oriented Programming, Addison Wesley, 1990.
3. I.Jacobson: Object Oriented Software Engineering, Addison Wesley, 1992.
4. B.Meyer: Object Oriented Software Construction, 1988, 2nd Ed, Prentice Hall.
5. D. Parsons: Object Oriented Programming with C++, 1995, 2nd Ed., BPB Publications.
6. R.S. Pressman: Software Engineering, 1972, 4th Ed., McGraw Hill
7. P.H. Winston and S. Narashimhan: on to Java, 1996, Addison - Wesley.

8. R. Wirfs-Brock and others: Designing Object Oriented Software, Prentice Hall, 1990.
9. E.Yourdon: Object Oriented System Design, 1994, Prentice Hall.

PG / CSE / T/ 115B VLSI System Design

Introduction to VLSI Design, Design Styles and parameters, popular technologies. Logic implementation with nMOS, CMOS. DCVS and PLAs. Pass vs.transistor logic,transit time, clocking, scaling, PLA minimization and folding, SIMPLIFY, ESPRESSO. Testability Issues. Physical Design algorithms: Partitioning, Floor planning and placement, Routing, compaction, gate arrays, FPGAs, MCMs. Data structures for layout desing -MAGIC. Design Rule checking, Expert systems, symbolic layout, complexity of layout algorithms.

References:

1. C.Mead & L.Conway: Introduction to VLSI Systems, Addison Wesley.
2. A.Mukherjee: Introduction to CMOS VLSI, Prentice Hall.
3. Fabricius: Introduction to VLSI Design, TMH.
4. T.Ohtsuki: Layout Design and Verification, North Holland.
5. N.Sherwani: Algorithms for VLSI Physical Design Automation, Kluwer Academic.
6. M.Sarrafzadeh & C.K.Wong:An Introduction to VLSI Physical Design, MH.

PG / CSE / T/ 115C Wireless Communication & Mobile Computing

Wireless Communication - Wired and wireless, Mobility of users and equipments, Overview of Electromagnetic Spectrum, Radio and Microwave communication, Infrared and Millimeter waves, Lightwave Transmission. Overview of Satellite Networks. Concepts of Spread Spectrum, CDMA System. Wireless LANs -MACA and MACAW protocols. Concepts of Cellular Network and related technologies like GSM, GPRS etc.

Mobile Computing – Characteristics, Infrastructure vs Infrastructureless Networks, Routing Protocols in Mobile Adhoc Network (MANET), Overview of Bluetooth Technology. Overview of Sensor Networks. Concepts of Mobile IP, Wireless Application Protocols and others. Overall security requirements and considerations in wireless and mobile computing systems. Concepts of fault tolerance.

References:

1. V.K.Garg & J.E.Wilks:Wireless and Personal Communication Systems: Fundamentals and Applications, IEEE Press and Prentice Hall,1996.
2. T.S.Rappaport, B.D.Woerner and J.H. Reed:Wireless Personal Communications: The Evolution of PCS,Dkyener Academic,1996.
3. G.I. Stuber: Principles of Mobile Communication,Kluener Academic,1996.
4. U.Black:Mobile and Wireless Networks, Prentice Hall PTR,1996.
5. Charles Parkins – Mobile Adhoc Ntworks
6. Wireless Communication- W. Stallings
7. Mobile Communication – J. Schiller
8. Reseach Papers of International Journals, Proceedings of Conferences.

PG / CSE / T/ 115D Machine Learning

Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. Inductive Classification . The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. The importance of inductive bias.

Decision Tree Learning: Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity. Occam's razor. Overfitting, noisy data, and pruning. Combining Multiple Leraners. Voting. Bagging. Boosting. Stacked Generalization. Cascading.

Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

Rule Learning: Propositional and First-Order. Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain. First-order Horn-clause induction (Inductive Logic Programming.

Artificial Neural Network Concepts: Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation..

Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. EM algorithm.

Instance-Based Learning: Constructing explicit generalizations versus comparing to past specific examples. k-Nearest-neighbor algorithm. Case-based learning.

Text Classification: Bag of words representation. Vector space model and cosine similarity. Relevance feedback and Rocchio algorithm. Versions of nearest neighbor and Naive Bayes for text. Clustering and Unsupervised Learning Learning from unclassified data. Clustering. Hierarchical Aglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabled data.

Language Learning: Classification problems in language: word-sense disambiguation, sequence labeling. Hidden Markov models (HMM's). Veterbi algorithm for determining most-probable state sequences. Forward-backward EM algorithm for training the parameters of HMM's.

References:

1. Michalski, Carbonnel & Michel (Eds.): Machine Learning - An A. I. Approach, Vols I,II & III, Morgan Kaufmann.
2. C. J. Thornton: Techniques in Computational Learning, Chapman & Hall Computing.
3. Ethem Alpaydin. Introduction to Machine Learning, MIT press
4. Tom M. Mitchel . Machine Learning. McgrawHill

Paper – VI

PG / CSE / T/ 116A Image Processing

Introduction, image definition and its representation, neighborhood. Orthogonal transformations like DFT, DCT, Wavelet.
Enhancement: contrast enhancement, smoothing and sharpening, filtering and restoration
Segmentation: pixel classification, global/local gray level thresholding, region growing, split/merge techniques, edge detection operators, Hough transform. Image feature/primitive extraction, component labeling, medial axis transform, skeletonization/thinning, shape properties, textural features – moments, gray level co occurrence matrix, structural features, Fourier descriptor, polygonal approximation. Compression: coding, quantization, spatial and transform domain based compression. Color image processing: color model, enhancement, and segmentation.
Mathematical morphology: basic concepts, erosion, dilation, opening, closing. Advanced applications like biomedical image processing, digital watermarking, etc

References:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, Addison-Wesley, California, 1993.
2. Rosenfeld and A. C. Kak, Digital Picture Processing, Vol. 1 & 2, 2nd ed. Academic Press, Inc. 1982.
3. Chanda and D. Dutta Mazumdar, Digital Image Processing and Analysis, Prentice Hall of India, New Delhi, 2000.

PG / CSE / T/ 116B Modeling and Simulation

Simulation and Modeling Objectives, Examples of application in various fields, General Concepts, Continuous and Discrete Models, Monte Carlo Simulation, Review of Basic Probability and Statistics, Stochastic Processes, Discrete Time Markov Chains, Petri Nets: Properties, Analysis and Applications, Variants of Petri Nets: Colored Petri Nets (CPN), Stochastic Petri Nets (SPN), Generalized Stochastic Petri Nets (GSPN), Random Number Generators, Pseudo Random Number Generators, Testing Random Number Generators, Queuing Theory, Distributed Simulation.

References:

1. Simulation Modeling & Analysis, by A. Law and D. Kelton, McGraw Hill Publishing Co., 2002.
2. Probability and Statistics with Reliability, Queuing, and Computer Science Applications, by Kishor S. Trivedi, John Wiley and Sons, New York, 2001
3. Creating Computer Simulation Systems: An Introduction to the High Level Architecture, Kuhl, Weatherly and Dahmann, Prentice Hall, 2000.
4. Simulation Model Design and Execution: Building Digital Worlds, by P. Fishwick, Prentice-Hall, 1995.
5. Discrete-Event System Simulation, by J. Banks, J. Carson, B. Nelson, D.Nicol, 3rd edition, Prentice Hall, 2001.
6. Parallel and Distributed Simulation Systems, by R.M. Fujimoto, John Wiley, 2000
7. Modelling with Generalized Stochastic Petri Nets, by M. Ajmone Marsan et al, Wiley, 1995
8. The Art of Computer Systems Performance Analysis, by R. Jain, Wiley, 1991.

9. Probabilistic Modelling, by I. Mitrani, Cambridge University Press, 1998
10. Computer and Communication Systems Performance Modeling, by P.J.B. King, Prentice Hall, 1991
11. Performance Modelling with Deterministic and Stochastic Petri Nets, by C. Lindemann,Wiley 1998
12. Theory of Modeling and Simulation, by Bernard P. Zeigler, Tag Gon Kim, Herbert Praehofer, Academic Press, 2000

PG / CSE / T/ 116C Information and Coding Theory

Information Theory
Information measures: entropy, relative entropy and mutual information. Asymptotic equipartition property. Entropy rates of stochastic processes. Data compression. Channel capacity. Differential entropy and the Gaussian channel.
Coding theory
Linear block codes: the generator and parity check matrices, Hamming codes.
Introduction to finite fields. Cyclic codes, Reed-Solomon codes. Convolutional codes and the Viterbi algorithm. Trellis coded modulation. Turbo codes

References:
1. R. W. Yeung, A First Course in Information Theory, New York, NY: Kluwer Academic/Plemu, Publishers, 2002.
2. R. G. Gallager, Information Theory and Reliable Communication, New York, NY: John Wiley and Sons, Inc., 1968.
3. H. Stark and J. W. Woods, Probability, Random Processes, and Estimation Theory for Engineers. 2nd Ed., Upper Saddle River, NJ: Prentice-Hall, Inc., 1994.

Category – Sessional Courses

Sessional – I

PG / CSE / S / 111 Assignment

Sessional – II

PG / CSE / S / 112 Seminar

Second Semester

Category - Departmental / Specialization Basket

Paper – VII

PG / CSE / T/ 127A Distributed Operating Systems

Intoductory Concepts. Communication in Distributed systems-Layered structure and protocols, ATM networks. Client-Server model, Remote procedure Call. Middlewares. Clock Synchronization. Resource Management, Concepts of threads, processor allocation, scheduling. Time stamp ordering. Distributed Mutual exclusion. Election algorithms.

Atomic transactions.Distributed concurrency control-concurrency control based on locking. Theorems on consistency. Deadlocks-General model, Detection methods in distributed systems. Distributed File Sytems-design issues. Important case studies.

References:

1. Singhal M.and Shivaratri N.G: Advanced Concepts in Operating Systems, McGraw Hill, N.Y.1994.
1. Sinha, P. K., Distributed Operating Systems – Concepts and Design, IEEE Cs Press, PHI, 1997

PG / CSE / T/ 127B Distributed Systems

Introduction: Important Issues. Models of Distributed Systems - Shared Memory Systems, Message Passing Systems. High level Nets Program Representation - Non-determinism - Guarded Commands - Atomicity-Fairness Central and Distributed Schedulers. Correctness Criteria - proving safety and liveness properties. Distributed Multual Excusion Distributed Shapshot Global State Collection Synchronous Message Passing -CSP-Client Server Computing. Fault Tolerant Systems-Fault Classification. Distributed Consensus-Byzantine Generals problem-Atomic Broadcast. Leader Election Clock Sunchronization.

References:

1. N.A.Lynch: Distributed Algorithms, Morgan Kayfmann Publishing Inc., CA,1996.
2. Tel: Introduction to Distributed Algorithms.
3. A.S. Tanenbaum: Distributed Operating Systems. Prentice Hall, N.J.,1995.

PG / CSE / T/ 127C Pattern Recognition

Introduction to pattern recognition and learning (supervised, unsupervised), training and test sets, feature selection.
Supervised learning and classification: Discriminant functions and decision boundaries Linear discriminant functions, relaxation procedure, non-separable behaviour Minimum distance classifier. Bayesian decision theory.Maximum likelihood classification. Parameter estimation, sufficient statistics, component analysis and discriminants (PCA, Fisher's) Nonparametric techniques. Density estimation, Parzen window, K-NN estimation
Unsupervised learning and clustering: Data description and clustering –similarity measures, criterion for clustering, Methods of clustering - partitional, hierarchical, graph theoretic, density based, Cluster validity
Feature extraction and feature selection: Problems of dimensionality- Feature extraction -- PCA-Feature selection –Karhunen Loeve, stochastic approximation, kernel approximation, divergence measures

References:

1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, 2nd ed., Wiley, New York, 2000.
2. J. T. Tou and R. C. Gonzalez, Pattern Recognition Principles, Addison-Wesley, London, 1974.

PG / CSE / T/ 127D Computational Geometry

Combinatorial Geometry: fundamental concepts, permutation tables, direction of point sets, zones in arrangements, complexities of families of cells.
Geometric Algorithms: Data Structures and complexity-construction and maintenance of convex hills; planar point location and triangulation, range search; line segment interconnection; proximity-closest pair, Voronoi diagrams; Half space intersection. Linear programming in 2, 3, and higher dimensions; intersection of polygons, polyhedron; geometry of rectangles; decomposition of polygons; visibility problems. NP-hard problems in geometry. Applications: Hidden line and Hidden surface elimination, Plano mover's problem; polygon containment problems, obstacle avoidance motion planning of robots; geometric modeling.

References:

1. F. P. Preparata and M. I. Shamos: Computational Geometry-An Introduction, Springer Verlag, 1985.
2. K. Mehlhorn: Data Structures and Algorithms, Vol. 3, Multidimensional Searching and Cimputational Geometry, Springer Verlag, 1984.
3. H. Edelsbrunner: Algorithms in Combinatorial Geometry, Springer Verlag, 1987.
4. J. O'Rourke: Art Gallery Theorems and Theorems and
5. Aookucations, Oxford University Press, 1986.

Paper VIII

PG / CSE / T/ 128A Complexity of Computation

Relativizations of the P = NP problem, Co-NP and function problems, Randomized Complexity classes-RP, PP, ZPP, BPP, Random Sources.

- Approximability thresholds, L-reductions, class MAXSNP, non - approximability results.
- Isomorphism and density Oracles.
- Inside P-class NC, P completeness, RNC algorithms.
- Logarithmic space, L = NL problem, Alternation classes, Games.
- Polynomial Hierarchy-Optimization problems. PNP, FP NP, Interactive protocols, Circuit Complexity measures, asymptotic results and universal circuits, Monotone functions, Threshold functions, Razborov's Method, Circuits and Turing Machines, Uniform circuits, Bounded depth circuits, branching programs.
- Algebraic complexity.

References:

1. C. H. Papadimitriou: Computational Complexity, Addision Wesley.
2. J. L. Balcazar et. al.: Structural Complexity, Vol I & II, Springer.
3. Paul E. Dunne: The complexity of boolean functions, Academic Press.
4. J. van Leeuwen ed,: Handbook of Theoretical Computer Science, Vol. A & B, Elsevier.
5. Wagner & Weichsung: Computational Complexity.

PG / CSE / T/ 128B Information Security

Introduction – An Overview of Information Security - Foundations of Information Security - confidentiality, integrity, privacy, authenticity, availability, trust and assurance - Security Engineering - Security Requirements Analysis - Risk and Vulnerability Analysis - Gap Analysis - Security Policies and controls - Security Testing and Validation - Security Tools and Techniques – Basics of Cryptography - Systems Security – Design Principles and Models - Certifying Information Security – Standards and Best Practices - Evaluating Information Security – Audits – IT Act - Digital Forensics.

Suggested Text:

1. Matt Bishop and Sathyanarayana S.Venkatramanayya, "Introduction to Computer Security", Pearson Education, 2005.

References:

1. Matt Bishop, "Computer Security: Art and Science", Pearson Education, 2003.
2. Vesna Hassler, "Security Fundamentals for E-Commerce", Artech House, 2001.
3. Ross Anderson, "Security Engineering: A Guide to Building Dependable Distributed Systems", John Wiley and Sons, 2008.
4. Thomas R. Peltier, "Information Security Risk Analysis", CRC Press LLC, 2005.
5. Dorothy E. Denning, "Information Warfare and Security", Addison Wesley, 1999

PG / CSE / T/ 128C Soft Computing

Fuzzy logic: Conventional and fuzzy sets, operations on fuzzy sets, fuzzy numbers, crisp relations and fuzzy relations, realization of fuzzy systems using fuzzy relations, application of fuzzy logic in optimization, vision, pattern recognition.
Neurocomputing: Introduction to neural networks, threshold logic
Models of neurocomputing: Perceptron,. Adaline, Multi-layer perceptron, backpropagation learning, RBF network, Hopfield networks, ART –I and II, SOFM. Applications in pattern recognition and image processing.
Evolutionary computing: Introduction to Evolutionary Computation: Genetic algorithms, Genetic programming, Evolutionary strategies, Evolutionary programming.
Genetic algorithms – Chromosome representation, encoding, decoding, Genetic operators: Selection, Crossover, Mutation, Elitism, Schema Theorem, EGA, Convergence theorem, real-coded GA, Ordered GA, Steady-state GA, Multi-objective evolutionary algorithms, applications in search and optimization. Recent advances in Evolutionary Computing (Particle Swarm Optimization, Ant Colony Optimization).
Hybridizations: Different types of integrations, merits. Neuron-fuzzy, Neuro-GA, Fuzzy-GA, Neuro-fuzzy-GA

References:

1. G. J. Klir and B. Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 1995.
2. K. H. Lee, First Course on Fuzzy Theory and Applications, Springer, 2005.
3. S. Haykin, Neural Networks: A Comprehensive Foundation, 2nd ed., Prentice Hall, New Jersey, 1999.
4. J. M. Zurada, Introduction to Artificial Neural Systems, West Publishing Co., St. Paul, Minnesota, 1992.
5. J. Hertz, A. Krogh, and R. G. Palmer, Introduction to the Theory of Neural Computation, Addison Wesley, California, 1991.

6. B. Yegananarayanan, Artificial Neural Networks, Prentice Hall of India, New Delhi, 1999.
7. C. M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995.
8. D.E. Goldberg, Genetic algorithms in search, optimization and machine learning, Addison Wesley, 1989.
9. Z. Michalewicz, Genetic algorithms + data structures = evolutionary programs, Springer-Verlag, 1994.
10. J.S.R Jang, C.T Sun and E Mizutani, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, Pearson Education, 1996.
11. S. Rajasekharan, G. A. V. Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI, 2003.
12. M. Dorigo aand T. Stutzle, Ant Colony Optimization, PHI, 2005.
13. J. Kennedy and R. C. Eberhart, Swarm Intelligence, Morgan Kaufmann Publishers Inc,US, 2001.

PG / CSE / T/ 128D Software Engineering

Introduction and Brief Overview - Software process, modeling and analysis, software architecture, software design.
Software Modeling, Analysis, Testing - Analysis modeling and best practices, traditional practice diagrams such as DFDs and ERDs etc, Traditional Testing techniques – white box and black box testing.
Object-Oriented Software Engineering - Concept of OO Software – Design and Analysis, Overview of various UML diagrams and UML analysis modeling, analysis case studies, analysis tools, analysis patterns, OO software testing. Case study with complete examples
Software Architecture - Architectural styles, architectural patterns, analysis of architectures, formal descriptions of software architectures, architectural description languages and tools, scalability and interoperability issues, web application architectures, case studies.
Software Design - Design best practices, design patterns, extreme programming, refactoring, design case studies, component technology, object oriented frameworks, distributed objects, object request brokers, case studies.
Web Engineering, Clean room Engineering and other recent topics

References:

1. G. Booch, J. Rumbaugh, and I. Jacobson, I. The Unified Modeling Language User Guide. Addison-Wesley, 1999
2. E. Gamma, R. Helm, R. Johnson, and J. Vlissides. Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley, 1995
3. M. Shaw and D. Garlan. Software Architecture: Perspectives on an Emerging Discipline. Prentice-Hall, 1996
4. L. Bass, P. Clements, and R. Kazman. Software Architecture in Practice, Addison-Wesley, 1998.
5. J. Rumbaugh, I. Jacobson, and G.Booch. The Unified Modeling Language Reference Manual. Addison Wesley Longman, 1999.
6. I. Jacobson, G. Booch, and J. Rumbaugh, and I. Jacobson. The Unified Software Development Process. Addison Wesley Longman, 1999.

7. J. Rumbaugh, M. Blaha, W. Premerlani, F. Eddy, and W. Lorenson. Object-oriented Modeling and Design. PHI, EEE, 1997.
8. G. Booch. Object-Oriented Analysis and Design with Applications. Second Edition. Benjamin Cummings, 1994.
9. Jim Conallen. Building Web Applications with UML. Addison-Wesley, 2000.
10. K. Beck. Extreme Programming Explained. Pearson Education Asia, 2000.
11. Software engineering – design, reliability and management – Schuman Mar.
12. Software engineering – Pressman.

PG / CSE / T/ 128E High Speed Networking

High-speed Modems: Dial-up and ADSL Modems.
High-speed (concurrent) data link protocols: Sliding window and time-multiplexed stop-and-wait
High-speed LANs and MANs: Fast and Gigabit Ethernet, FDDI, DQDB and Fibre Channel
Queuing Theory and applications: Preliminaries; discussions of important results and network applications of M/M/1 and M/G/1 queuing systems.
ISDN, B-ISDN, Frame Relay and ATM: Introduction, telephone network overview; broad features of ISDN, B-ISDN and Frame Relay networks; design features, protocol-layered architecture and high-speed operation of ATM network.
Review of TCP/IP and the global Internet
High-speed IP router design: IP router intervals, making NICS and switching fabrics faster.
High speed packet processing: Overview of different packet processing functions performed by a router; high-speed implementation of IP address lookup and packet filtering/packet classification
Overview of network processors

Paper IX

PG / CSE / T/ 129A Combinatorial Algorithm

Ear decompositions, Nonbipartite matching, Gallai-Milgram and Bessy-Thomasse theorems on partitioning/covering graphs by directed paths/cycles, Minimization of submodular functions, Matroid intersection, Polymatroid intersection, Jump systems, Matroid union, Matroid matching, path matchings, Packing trees and arborescences, Packing directed cuts and the Lucchesi-Younger theorem, Submodular flows and the Edmonds-Giles theorem, Graph orientation, Connectivity tree and connectivity, augmentation, Multicommodity flows.

PG / CSE / T/ 129B Natural Language Processing

Parsing & Grammar - Lexical Functional Grammar, Tree Adjoining Grammar, Government & Binding, Paninian Grammar. Comparison of Paninian Grammar with others.

- Semantic Interpretation - Logical Semantics, Script, Conceptual Dependency.
- Discourse Interpretation - Paragraph, Story, Dialogue understanding. Anaphora Resolution.
- Natural Language Generation.

- Machine Translation with special reference to Indian Languages.
- NLP systems - Natural Language Interfaces to Databases.

References:

1. Grasz, Jones & Webber (Ed.): Readings in Natural Language Processing, Morgan Kaufmann, 1986.
2. Gazdar & Mellish: Natural Language Processing in PROLOG, Addision Wesley, 1989.
3. Leonard Bolc. (Ed.): Natural Language Parsing Systems, Springer Verlag, 1987.
4. McDonald & Bolc. (Ed.): Natural Language Generation Systems, Springer Verlag, 1987.
5. W. J. Hutchins: Machine Translation - Past, Present & Future, Ellis Horwood, 1986.
6. Bharati, Chaitanya and Sangal: Natural Language Processing- a Paninian perspective, PHI, 1985.

PG / CSE / T/ 129C Data Warehousing & Data Mining

Introduction, Data warehousing and OLAP technology for data mining, Classification of data mining techniques, Discovery and analysis of patterns, trends, and deviations, Data pre-processing, Data mining primitives, languages and systems, Data mining models: decision trees, genetic algorithms, neural nets, etc. Clustering, Enabling data mining through data warehouse. Data marts, Multidimensional databases, Data mining applications, Descriptive data mining: characterization and comparison, Association analysis, Classification and prediction, Cluster analysis, Mining complex types of data, Applications and trends in data mining

References:

1. Adriaans, P. (1996), Data mining, Addison-Wesley
2. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers
3. Margaret Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall
4. Weiss, Sholom M.. - Predictive data mining : a practical guide / Sholom M. Weiss, Nitin Indurkhy. - San Francisco, Calif. : Morgan Kaufmann Publishers, 1998. - 1558604030
5. Advances in knowledge discovery and data mining / edited by Usama M. Fayyad. - Menlo Park, Calif. : AAAI Press; Cambridge, Mass.; London : MIT
6. Thomsen, Erik, 1959-. - OLAP solutions : building multidimensional information systems / Erik Thomse. - 2nd ed. - New York; Chichester : Wiley
7. Mitchell, Tom M., Tom Michael, 1951-. - Machine learning / Tom M. Mitchell. - New York; London : McGraw-Hill

PG / CSE / T/ 129D VLSI Testing & Verification

Faults, errors and fault models: Stuck-st, stuck-open, stuck-on, bridging, physical, delay; PLA fault, memory fault; t-diagnosable systems. Single and Multiple stuck-at faults. Fault equivalence, dominance, collapsing, check-points. Test generation- Boolean differences, D-algorithm, PODEM, FAN; testability analysis, random sampling and random pattern testability, testability directed test generation. Design for testability, Built-in self test techniques, LSSD Syndrome and parity testing; signature analysis. Testing of sequential

circuits-scan path, full and partial scan, random path self checking designs, m-out -of -n codes, Berger code, testing of delay and stuck-open faults. Verification: Verification by simulation, techniques of formal verification, use of BDDs in verification.

References:

1. M. Abramovici, M. A. Breuer and A. D. Friedman: Digital Systems Testing and Testable Design, Computer Science Press, New York, 1990.
2. V. D. Aggarwal and S. C. Seth: Tutorial: Test Generation for VLSI chips, IEEE computer Society Press, Washington D. C. 1988.

PG / CSE / T/ 129E Cryptography

Extended Euclidean Algorithm, Congruence, Chinese Remainder Theorem, Euler's Theorem, Primitive elements and conjugates in finite fields, Quadratic Reciprocity Law, Jacobi and Legendre's symbols, Gaussian Integers, Carmichael Numbers and strong pseudo-primes, Addition Chain Problems.

- Factorization schemes of Solovay-Strassen, Miller-Rabin, Pollard, Factor bases and Continued Fraction methods.
- Classical Cyphers and one time pad, Public Key Cryptography-Diffie Hellmann, RSA, Massey O'Mara, EI Gamal Schemes, Kbapsacj based schemes, Mental Poker, Linear Feedback Shift Registers-Threshold schemes for Key Management, Access Control, Inference Control-Security of Statistical Databases.
- Elliptic curve Cryptosystems and Factorization-Lenstra's Algorithm.
- Packing and Covering radii of codes, Golay Code, Reed-Mueller Code, BCH Code, Reed Solomon Code, Quadratic Residue Code, Alternant Code, Goppa Code, Justine Code, MDS Codes, Invariant theory and self-dual codes, Concatenated codes, Bounds of Singleton, Johnson, Plotkin and Elias.
- Group Algebra, Weight Enumerators and Krawtchouk Polynomials, Automorphism groups of codes, Designs and codes-intersection numbers of t-designs.

References:

1. Neal Koblitz: A Course in Number Theory and Cryptography, Springer.
2. Itrlsnf & Rosen: Second Course in Number Theory, Springer.
3. Evangels Kramakis: Primality & Cryptography, John Wiley.
4. Mc Williams & Sloanne: Theory of Error Correcting Codes, Vol. I & II, Elsevier.
5. Steven Roman: Coding and Information Theory, Springer.

Category – Inter Disciplinary Basket

Paper – X

PG / CSE / T/ 1210A Service Oriented Architecture

SOA Fundamentals: Defining SOA, Business Value of SOA, Evolution of SOA, SOA characteristics, concept of a service in SOA, misperceptions about SOA, Basic SOA architecture, infrastructure services, Enterprise Service Bus (ESB), SOA Enterprise Software models, IBM On Demand operating environment.
Web services Technologies: XML technologies – XML, DTD, XSD, XSLT, XQuery, XPath Web services technologies - Web services and SOA, WSDL, SOAP, UDDI.

WS Standards (WS-*) - Web services and Service-oriented enterprise (SOE), WS-Coordination and WS-Transaction, Business Process Execution Language for Web Services (BPEL4WS), WS-Security and the Web services security specifications, WS-Reliable Messaging, WS-Policy, WS-Attachments.
SOA Planning and Analysis: Stages of the SOA lifecycle, SOA Delivery Strategies, service-oriented analysis, Capture and assess business and IT issues and drivers, determining non-functional requirements (e.g., technical constraints, business constraints, runtime qualities, non-runtime qualities), business centric SOA and its benefits, Service modeling, Basic modeling building blocks, service models for legacy application integration and enterprise integration, Enterprise solution assets(ESA).
SOA Design and implementation: service-oriented design process, design activities, determine services and tasks based on business process model, choosing appropriate standards, articulate architecture, mapping business processes to technology, designing service integration environment (e.g., ESB, registry), Tools available for appropriate designing, implementing SOA, security implementation, implementation of integration patterns, services enablement, quality assurance.
Managing SOA Environment: Distributing service management and monitoring concepts, operational management challenges, Service-level agreement considerations, SOA governance (SLA, roles and responsibilities, policies, critical success factors, and metrics), QoS compliance in SOA governance, role of ESB in SOA governance, impact of changes to services in the SOA lifecycle.

References:

1. Service-Oriented Architecture: Concepts, Technology, and Design, by Thomas Erl, Prentice Hall Publication, 2005
2. Service-Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap, by Norbert Bieberstein, Sanjay Bose, Marc Fiammante, Keith Jones, Rawn Shah, IBM Press Publication, 2005
3. The New Language of Business: SOA & Web 2.0 by Sandy Carter, IBM Press, 2007
4. Service-Oriented Architecture: A Field Guide to Integrating XML and Web Services by Thomas Erl, Prentice Hall Publication, 2004

PG / CSE / T/ 1210B Multimedia Technologies

Introduction, Nature of Multimedia Data, Multimedia Peripherals & Devices, Storage of Multimedia Data, Different Data Compression Techniques, A Temporal Model for Interactive Multimedia, Multimedia Databases, Clustering for Multimedia Object Storage, Clustering Algorithms, Querying and Content Retrieval in Multimedia Databases, Distributed Multimedia Systems.

References:

1. J. Keyes: Multimedia Handbook, MH.
2. G. Blair, L. Blair, A. Chetwynd, H. Bowman: Formal Specification of Distributed Multimedia Systems, UCL Press, London.
3. S. Khoshafian, A. Brad Baker: Multimedia and Imaging Databases, Morgan Kaufmann.

PG / CSE / T/ 1210C Network Security

Introduction – Basic Security Concepts - Threats, Vulnerabilities, and Attacks - Encryption, Digital Signatures, and Certification Authorities - Kerberos Key Exchange - Encryption on the World Wide Web - E-Mail Security - Operating System Security - LAN Security - Media and Protocols - Routers and SNMP - Virtual Private Networks – Firewalls – Biometrics - Policies and Procedures - Auditing, Monitoring, and Intrusion Detection - Crisis Management – Cookies and Cache – Security of Web-based Systems

Suggested Text:

1. John E. Canavan, "Fundamentals of Network Security", Artech House, 2001.
2. William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, 2006.

References:

1. Matt Bishop and Sathyanarayana S.Venkatramanayya, "Introduction to Computer Security", Pearson Education, 2005.
2. Matt Bishop, "Computer Security: Art and Science", Pearson Education, 2003.
3. Nitesh Dhanjani and Justin Clarke, "Network Security Tools", O'Reilly, 2005.

PG / CSE / T/ 1210D Parallel Computing Techniques

Introduction to High Performance Computing: Milestones and applications.
High-Performance Computing architectures: Overview of the major classes of HPC architectures and their evolution.
Parallel programming models and performance analysis: Parameterisation, modeling, performance analysis, Amdahl's law, efficiency, and benchmarking of systems.
Programming parallel computers: Overview of parallel programming, parallel languages, parallelizing compilers, message passing and data parallel programming models, introduction to MPI and OpenMP.
Multi-Thread Models with primary sources of overhead, memory architecture and memory access times and associated sources of overhead; Multi-Process Execution Model; Performance Tuning via Overhead Reduction; Task Scheduling; Data Partitioning and its Effect on Performance.
Restructuring for Parallel Performance - Loop Transformations; Data Transformations; Dependence Analysis; Compiler Strategies.
Parallel Algorithms - Cyclic Reduction; Iterative Algorithms (Jacobi, Gauss-Seidel and Red-Black Orderings);
Divide-and-Conquer Algorithms, Adaptive Quadrature.

References:

1. Introduction to Parallel Computing, Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, 2003.
2. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, 2007.
3. *Parallel Programming in C with MPI and OpenMP* by M.J. Quinn, McGraw-Hill Science/Engineering/Math
4. Other materials will be provided in the class.

PG / CSE / T/ 1210E Bioinformatics

Fundamental of Cell Biology: Prokaryotes to eukaryotes, Single cells to multicellular organisms, Structure of cell, Internal organization of cell, Central dogma, DNA-RNA-Protein, Transcription, Translation, Gene, Promoter
Integrated Biology and Biomolecular Structure: Comparative Genomics, Regulation of Gene Expression, Gene regulatory network, Metabolic Pathways, Primary, Secondary, Tertiary and Quaternary structure of Poteins, alphahelix, betasheet, beta turn, random coil, Ligand , WatsonCrick model of DNA, DNA condensation, RNA structure. Quantitative Structure Activity Relation (QSAR), Active site, Docking, Rational Drug Design, Gene expression data analysis, Transcriptomics and DNA microarrays Proteomics expression, Normalization, Clustering and classification algorithms
Some Tasks in Computational Biology: Fragment assembly, Sequence alignment, Gene finding, Promoter identification, Phylogenetic tree construction, Protein superfamily classification, Protein structure prediction, Protein folding

References:

1. Introduction to Bioinformatics, Arthur M. Lesk, 2002, Oxford University Press
2. Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, 2001, Prentice Hall

Category – Sessional Courses

Sessional – I

PG /CNS / S / 121 Term Paper Leading to Thesis

Sessional – II

PG /CNS /S / 122 Seminar

Third and Fourth Semester

Sessional 1

PG /CNS / TH / 21 Thesis Work

Sessional 2

PG /CNS / VV/ 22 Viva – Voce