Department of Computer Science & Engineering

M.Tech., Computer Science & Engineering
Teaching Scheme
(2011 onwards)

FIRST SEMESTER

S.No.	Course No.	Course Title	L	T	P	Hours/Week	C
1.	CS-600	Topics in Computer Networks	3	0	0	3	3
2.	CS-601	Topics in Software Engineering	3	0	0	3	3
3.	CS-602	Architecture of Large Systems	3	0	0	3	3
4.		Programme Elective-1	3	0	0	3	3
5.		Programme Elective-2	3	0	0	3	3
6.	CS-603	Computational Lab-I	0	0	3	3	2
Total			**15**	**0**	**3**	**18**	**17**

SECOND SEMESTER

S.No.	Course No.	Course Title	L	T	P	Hours/Week	C
1.	CS-604	Advanced Algorithms	3	0	0	3	3
2.	CS-605	Advanced Operating System	3	0	0	3	3
3.	CS-606	Advances in DBMS	3	0	0	3	3
4.		Programme Elective-3	3	0	0	3	3
5.		Open Elective-1 (from other Dept)	3	0	0	3	3
6.	CS-607	Computational Lab-II	0	0	3	3	2
Total			**15**	**0**	**3**	**18**	**17**

THIRD SEMESTER

S.No.	Course No.	Course Title	L	T	P	Hours/Week	C
1.	CS-799	Self Study				3	2
2.	CS-800	Seminar	0	0	3	3	2
3.	CS-801	Dissertation (to be continued in IVth Sem)				24	12
Total						**30**	**16**

FOURTH SEMESTER

S.No.	Course No.	Course Title	L	T	P	Hours/Week	C
1.	CS-801	Dissertation (continued from IIIrd Sem)				40	20
Total						**40**	**20**

Programme Electives

CS-700	Artificial Intelligence
CS-701	Formal Languages and Automata Theory
CS-702	Computer Vision and Image Processing
CS-703	Topics in Cloud Computing
CS-704	Cryptography and Computer Security
CS-705	CAD of Digital Systems
CS-706	Combinatorial Optimization
CS-707	Software Project & Quality Management
CS-708	Software Testing
CS-709	Graph Theory and Network Algorithms
CS-710	Real Time System Design
CS-711	Intrusion Detection System
CS-712	Information Theory and Coding
CS-713	Game Theory
CS-714	Bioinformatics
CS-715	Biometric Security
CS-716	Soft Computing
CS-717	Cluster and Grid Computing
CS-718	Embedded Systems
CS-719	Fault Tolerant Computing
CS-720	Parallel Algorithms
CS-721	Performance Evaluation of Computer System
CS-722	Speech and NLP
CS-723	Advances in Compiler Construction
CS-724	Formal Methods in Secure Computing

In addition to these electives, any other core/elective floated for M.Tech., Mobile Computing may also be floated as elective for M.Tech., Computer Science & Engineering

Open Electives

CS-750	Modeling & Simulation
CS-751	Computer Graphics

CSE-600 Topics in Computer Networks L-T-P-C: 3-0-0-3

Overview and motivation, Resource sharing, Design issues for the network layers
Networking devices
Principles of internetworking, Tunneling, Fragmentation, Naming and addressing concepts, Hierarchical naming, Domain name system, Name resolution process, IP address classes and concept of subnetting, Classless Inter-domain routing (CIDR) and DHCP concepts, The internet protocols: IP, ICMP, ARP, RARP
The design issues for the transport layer, addressing, establishing connection, flow control and multiplexing.
The internet protocols: TCP and UDP.
Multicast routing
Mobility in networks, Mobile IP
Emerging trends in networking

Books and References

1. B.A. Forouzan, Data Communications and Networking, McGraw Hill.
2. A.S. Tanenbaum, Computer Networks, PHI.
3. Libor D. and Alena K., Understanding TCP/IP. PACKT Publishing.
4. Dharma P. Agrawal and Q-An Zeng, Introduction to Wireless and Mobile Systems, Thomson Learning Inc.

CSE-601 Topics in Software Engineering L-T-P-C: 3-0-0-3

The course will focus on the state-of-the-art in various areas of Software Engineering-- Software project management, Metrics and measurement, Software configuration management, Software risk management, Requirements engineering, Software quality assurance, Software reliability models, Object oriented design, Formal specifications, Formal verification of programs, Jackson method for design, CASE tools and technology, UML, eXtreme Programming, Aspect Oriented Programming, secure software engineering principles.

Books and References

1. Pankaj Jalote. *An Integrated Approach to Software Engineering*. Narosa Publishing House.
2. S. L. Pfleeger. *Software Engineering*, MacMillan Publishing Company
3. Roger Pressman. *Software Engineering: A Practitioner's Approach*. McGraw-Hill Publishing.

CSE-602 Architecture of Large Systems L-T-P-C: 3-0-0-3

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, Coherence and 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, superscalar, superpipelined 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. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

Books and References

1. David Patterson & John Henessey. Computer Organization and Design: A Hardware/Software Interface.
2. John Henessey & David Patterson. Computer Architecture: A Quantitative Approach.

CSE-604 Advanced Algorithms L-T-P-C: 3-0-0-3

Introduction: Algorithm Design paradigms- motivation, concept of algorithmic efficiency, run time analysis of algorithms, Asymptotic Notations; Divide and Conquer approach, examples of some sorting techniques; Greedy Algorithms; Graph Algorithms: Representation of graphs, BFS, DFS, single source shortest path, all pair shortest path; Dynamic programming: Overview, difference between dynamic programming and divide and conquer, Traveling salesman Problem, longest Common sequence, 0/1 knapsack., Backtracking: 8-Queen Problem, Sum of subsets, graph coloring, Hamiltonian cycles;
Branch and bound: its application for some of above problems; Computational Complexity: Complexity measures, Polynomial Vs non-polynomial time complexity; NP-hard and NP-complete classes, examples.

Books and References

1. T. Cormen, C. Leiserson, R. Rivest, and C. Stein. Introduction to Algorithms. 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

CSE-605 Advanced Operating System L-T-P-C: 3-0-0-3

Theory and implementation aspects of distributed operating systems. Process synchronization in multiprocessing/multiprogramming systems. Inter-process communication and co-ordination in large distributed systems. Distributed resource management. Fundamentals of real time operating systems. Case studies. Information management in distributed systems: security, integrity and concurrency problems. Fault tolerance issues. OS issues related to the Internet, intranets, pervasive computing, embedded systems, mobile systems and wireless networks. Case studies of contemporary operating systems.

Books and References

1. M. Signal & N. Shivaratri, Advanced Concepts in Operating Systems: Distributed, Database and Multiprocessor Operating Systems, McGraw Hill International Edition.
2. R.K. Sinha. Distributed Operating Systems. Prentice Hall

CSE-606 Advances in DBMS L-T-P-C: 3-0-0-3

Database Management systems concepts, Conceptual Database Design, Logical Database Design Physical Database Design, Query Processing, Transaction processing, Crash recovery, Concurrency control, Distributed Database, client/server database. Integrity security and repositories. Emerging Database trends, Design and database administration skills based on near-real life applications.

Books and References

1. R.Elmasri, S. Navathe, Benjamin Cummings. Fundamentals of Database Systems.
2. C.J.Date, An introduction to Data Base systems. Addison Wesley.
3. Silberschatz–Korth–Sudarshan. Database System Concepts. Tata McGraw Hill.
4. Vaakevitch David. Client/server Strategies. Galgotia Publications.

CSE-700 Artificial Intelligence L-T-P-C: 3-0-0-3

Introduction: Introduction to AI, AI techniques, level of model, criteria for success.
Function and Recursion, Tuples, patterns, Lists, concrete data types, Inductive definitions, Induction on concrete data, Formal syntax, Operational semantics, operational reasoning, references, The environmental model, exceptions, polymorphism, typing subtyping, inference. AI application development using SML.

The major methods of representing knowledge in AI: Rule based representations, declarative or logical formalisms, Prolog programming, frames or objects oriented systems, network based approaches, semantic network, and finally mixed representations.
For each of them the emphasis will be along three dimensions: The building of tools in which all knowledge is to be represented. The use of these tools to actually represent knowledge, and the use of this represented knowledge to solve problems (i.e., essentially control issues).
Case study of one or more examples from natural language processing, question answering, speech, expert systems, etc.

Books and References

1. *ML for the Working Programmer*, Larry Paulson, Cambridge University Press. Warning: Not easily available
2. The SML Basis Library, including information on useful common functions included with most implementations of SML.
3. A Gentle Introduction to ML, by Andrew Cumming.
4. Tips for Computer Scientists on Standard ML, by Mads Tofte.
5. *Art of Prolog*, Ehud Shapiro
6. Artificial Intelligence, Ritche & Knight

CSE-701 Formal Languages and Automata Theory L-T-P-C: 3-0-0-3

Propositional calculus and Predicate Calculus, Satisfiabiliy and validity, Notions of soundness and completeness
Chomsky Hierarchy of Grammars and the corresponding acceptors, Turing Machines, Recursive and Recursively Enumerable Languages; Operations on Languages, closures with respect to the operations.
Church-Turing Thesis, Decision Problems, Decidability and Undecidability, Halting Problem of Turing Machines; Problem reduction (Turing and mapping reduction).
Time Complexity, Space Complexity

Books and References

1. John E. Hopcroft, Rajeev Motwani, Jeffery Ullman, Introduction to Automata theory, Langauges & computation, Pearson Education.
2. Thomas A. Sudkamp, An Introduction of Theory of Computer Science Languages and Machine, Pearson Education.
3. Michael Sipser, Introduction of the Theory of computation, Thomson Publication.
4. Kamala Krithivasan, Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson Education.

CSE-702 Computer Vision and Image Processing L-T-P-C: 3-0-0-3

Digital Image Fundamentals; Image Enhancement in Spatial Domain; Gray Level Transformation, Histogram Processing, Spatial Filters; Image Transforms; Fourier Transform and their properties, Fast Fourier Transform, Other Transforms; Image Enhancement in Frequency Domain; Colour Image Processing; Image warping and restoration; Image Compression; Image Segmentation; edge detection, Hough transform, region based segmentation; Morphological operators; Representation and Description; Features based matching and Bayes classification; Introduction to some computer vision techniques; Imaging geomerty, shape from shading, optical flow; Laboratory exercises will emphasize development and evaluation of image processing methods.

Books and References

1. R. GONZALEZ and R. E. WOOD, Digital Image Processing, Prentice Hall of India.
2. ANDRIAN LOW, Introductory Computer Vision and Image Procession, McGraw Hill CO.
3. W.K. PRATT, Digital Image Processing, McGraw Hill.
4. A.K. JAIN, Fundamentals of Image Processing.

CSE-703 Topics in Cloud Computing L-T-P-C: 3-0-0-3

Unit 1: Introduction to Cloud Computing

Roots of Cloud Computing, Layers and Types of Clouds, Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, and Challenges and Opportunities.

Unit 2: Virtualization and Resource Provisioning in Clouds

Introduction and Inspiration, Virtual Machines (VM), VM Provisioning and Manageability, VM Migration Services, VM Provisioning in the Cloud Context, and Future Research Directions.

Unit 3: Cloud Computing Architecture

Cloud Benefits and Challenges, Market-Oriented Cloud Architecture, SLA-oriented Resource Allocation, Global Cloud Exchange; Emerging Cloud Platforms, Federation of Clouds

Unit 4: Programming Enterprise Clouds using Aneka

Introduction, Aneka Architecture, Aneka Deployment, Parallel Programming Models, Thread Programming using Aneka, Task Programming using Aneka, and MapReduce Programming using Aneka, Parallel Algorithms, Parallel Data mining, Parallel Mandelbrot, and Image Processing.

Unit 5: Advanced Topics and Cloud Applications:

Integration of Private and Public Clouds, Cloud Best Practices, GrepTheWeb on Amazon Cloud, ECG Data Analysis on Cloud using Aneka, Hosting Massively Multiplayer Games on Cloud, and Content Delivery Networks Using Clouds, and Hosting Twitter and Facebook on Cloud.

Books and References

1. Rajkumar Buyya, James Broberg, and Andrzej Goscinski, Cloud Computing: Principles and Paradigms, ISBN-13: 978-0470887998, Wiley Press, New York, USA, February 2011.

CSE-704 Cryptography and Computer Security L-T-P-C: 3-0-0-3

Introduction: need and basic goals for computer security, security threats etc.
Cryptography : Elementary number theory, Finite fields, Arithmetic and algebraic algorithms, Secret key and public key cryptography, Pseudo random bit generators, Block and stream ciphers, Hash functions and message digests, Public key encryption, Probabilistic encryption, Authentication, Digital signatures, Zero knowledge interactive protocols, Elliptic curve cryptosystems, Formal verification, Cryptanalysis, Hard problems
Network Security: problems in network security; kinds of attacks, PKI, key exchange protocols, example protocols such as PGP, Kerberos, IPSEC/VPN, SSL, S/MIME etc. Protocol vulnerabilities: examples of protocol vulnerabilities such as in TCP/IP, denial of service attacks etc. Tools for network security such as firewalls and intrusion detection systems.

Books and References

1. Cryptography, Theory and Practice, Douglas R. Stinson, CRC Press,
2. Cryptography and Network Security: Principles and Practices, W. Stallings, Prentice Hall
3. Applied cryptography, B. Schneier, John Wiley & Sons
4. Handbook of Applied Cryptography, A. Menezes, P. Van Oorschot, S. Vanstone, CRC Press
5. Network Security, C. Kaufman, R. Perlman, M. Speciner, Prentice Hall
6. Introduction to Cryptography with coding theory, wade Trappe, Lawrence C. Washinton, Pearson Education

CSE-705 CAD of Digital Systems L-T-P-C: 3-0-0-3

Introduction: VLSI design flow, challenges. Verilog/VHDL: introduction and use in synthesis, modeling combinational and sequential logic, writing test benches.
Logic synthesis: two-level and multilevel gate-level optimization tools, state assignment of finite state machines. Basic concepts of high-level synthesis: partitioning, scheduling, allocation and binding. Technology mapping. Testability issues: fault modeling and simulation, test generation, design for testability, built-in self-test. Testing SoC's.

Basic concepts of verification. Physical design automation. Review of MOS/CMOS fabrication technology. VLSI design styles: full-custom, standard-cell, gate-array and FPGA. Physical design automation algorithms: floor-planning, placement, routing, compaction, design rule check, power and delay estimation, clock and power routing, etc. Special considerations for analog and mixed-signal designs.

Books and References

1. Giovanni De Micheli. Synthesis and Optimization of Digital Circuits.

CSE-706 Combinatorial Optimization L-T-P-C: 3-0-0-3

Optimization Problem: Global and Local optima; Convex sets and functions; Convex programing problem; Simplex algorithm: Forms of linear programming problem; Geometry of linear program; Duality: Dual of a linear program in general form; shortest path problem and its dual; Dual simplex algorithm; Primal dual algorithm: Shortest path problem, max flow; Algorithms and complexity: Computability; time bound; analysis of algorithm; polynomial time algorithm; Algorithm for matching; weighted matching. Special topics in Combinatorial Optimization

Books and References

1. C.H. Papadimitriou, K. Steiglitz, *Combinatorial optimization: algorithm and Complexity*, Prentice Hall of India.
2. D. Knuth, *Art of Computer Programming*, Vol. IV, Addison Wesley.
3. C.H. Papadimitriou, *Computational Complexity*, Addison Wesley.

CSE-707 Software Project & Quality Management L-T-P-C: 3-0-0-3

Introduction to S/W project management, S/W project management competencies, responsibilities of a software project manager, Software process, S/W process models, project planning, organization of project team, S/W size estimation, estimation of effort & duration, Halstead's software Science, models, dependency & scheduling, staffing, Organizing a software engineering project, S/W configuration management, monitoring & controlling S/W projects, developing requirements, risk management, project tracking & control, communication & negotiating, S/W quality, S/W quality engineering, defining quality requirements, quality standards, practices & conventions, ISO 9000, ISO 9001, S/W quality matrices, managerial and organization issues, defect prevention, reviews & audits, SEI capability maturity model, PSP, six sigma. Special topics in process and quality management.

Books and References

1. B. Hughes, M. Cotterell, Software Project Management, McGraw Hill.

2. R. Walker, Software Project Management, Pearson.
3. R. H. Thayer, Software Engineering Project management, IEEE CS Press.
4. R. Pressman, Software Engineering A Practitioner's approach, McGraw Hill.

CSE-708 Software Testing L-T-P-C: 3-0-0-3

Introduction, Basic concepts, discrete mathematics for testers, Graph theory for testers,Black box testing: Boundary value testing, Equivalence class testing, White box testing: statement coverage, Branch coverage, condition coverage, path coverage, Mc Cabe's cyclomatic complexity; Decision Table based testing, Data flow based testing, Integration testing, System testing, Interaction testing, Performance testing, Mutation testing, Regression testing, error seeding , object oriented testing: issues in object oriented testing , Test case design by object oriented software, Fault based testing, test cases and class hierarchy, Scenario based Test design, Testing surface structure and deep structure, Class 11 testing: Random testing for object oriented classes, Partition testing at the class level; Inter class test case design: multiple class testing, tests derived from behavior models, Test case generation using UML diagrams, GUI testing, object oriented system testing. Special topics in software testing.

Books and References

1. C. J. Paul, Software testing: A craftsmen's approach, CRC Press.
2. R. Gopalswamy, Software testing, Pearson.
3. G. J. Myers, The art of software testing, Wiley Interscience New York.
4. R. S. Pressman, Software Engineering A Practitioner's approach, McGraw Hill.
5. R. Mall, Fundamentals of Software Engineering, Prentice Hall of India

CSE-709 Graph Theory and Network Algorithm L-T-P-C: 3-0-0-3

Introduction: Graphs, Isomorphism, Walks, Paths, Circuits, Trees, Properties of Trees, Cotrees and Fundamental Circuits, Cut Sets, Fundamental Cut Sets and Cut Vertices, Planar and Dual Graphs, Metric Representation of Graphs, Coloring and covering and partitioning of a graph, chromatic number, chromatic partitioning, chromatic olynomials, matching, covering, four color problem, Directed graphs, some type of directed graphs, Directed paths, and connectedness, Euler digraphs, trees with directed edges, fundamental circuits in digraph, matrices A, B and C of digraphs adjacency matrix of a digraph,enumeration, types of enumeration, counting of labeled and unlabeled trees, polya's

theorem, graph enumeration with polya's theorem; Graph Algorithms: Elementary Graph 12 Algorithms, Representations of graphs, Breadth-first search, Depth-first search, Topological sort, strongly connected components; Minimum Spanning Trees: Growing a minimum spanning tree, The algorithms of Kruskal and Prim, Single-Source Shortest Paths: Shortest paths and relaxation, Dijkstra's algorithm, The Bellman-Ford algorithm, Singlesource shortest paths in directed acyclic graphs, Difference constraints and shortest paths, All-Pairs Shortest Paths: Shortest paths and matrix multiplication, The Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs, and A general framework for solving path problems in directed graphs; Maximum Flow: Flow networks, The Ford-Fulkerson method, Maximum bipartite matching, Preflow-push algorithms, The lift-to-front algorithm. Special topics in graph theory and network algorithms.

Books and References

1. T. H. Cormen, C. E. Leiserson and R. L. Rivest, Introduction to Algorithms, Prentice Hall of India.
2. N. Deo, Graph Theory with Applications to Engineering and Computer Science,Prentice Hall of India.
3. D. B. West, Introduction to Graph Theory, Prentice Hall of India.
4. R. Diestel, Advanced Graph Theory, Springer Verlag Heidelberg, New York.
5. M. T. Goodrich and R. Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Wiley.

CSE-710 Real Time System Design L-T-P-C: 3-0-0-3

Introduction to Real Time systems, applications of Real Time systems, basic model of Real Time systems, characteristics of Real Time systems, types of Real Time systems: hard, firm, soft, timing constraints, modeling timing constraints, Real Time task scheduling: basic concepts, clock driven scheduling, table driven scheduling, cyclic, schedulers, hybrid schedulers, event driven scheduling, EDF Scheduling, RMA, DMA, resource sharing among RT tasks, Priority inversion, Priority Inheritance Protocol, Highest Locker Protocol, Priority Ceiling Protocol, Scheduling Real Time tasks in multiprocessor and distributed systems, Fault tolerant scheduling of tasks, clocks in distributed Real Time systems, Commercial Real Time Operating Systems, timers, UNIX and Windows as RT OS, POSIX, PSOS, VRTX, QNX, RT Linux, Lynx, other RT OS, benchmarking RT OS, RT communications, QoS framework, models, Real Time Communication in a LAN, IEEE 802.4, RETHER, Communication over Packet Switched Networks, Routing algorithms, RSVP, rate control, RT databases, Applications, characteristics of temporal data, Concurrency control, Commercial RT databases. Special topics in real time systems.

Books and References

1. J. W. S. Liu, Real time Systems, Pearson Education.

2. R. Mall, Real Time Systems, Pearson.
3. C. M. Krishna and K. G. Shin, Real Time Systems, McGraw Hill.
4. P. A. Laplante, Real Time Systems Design & Analysis, Willey.

CSE-711 Intrusion Detection System L-T-P-C: 3-0-0-3

Introduction:IDS, Types of IDS, host based IDS, Network based IDS, Stack based IDS, signature Based IDS, anomaly based IDS, TCP/IP and security concerns, DNS and security concerns, Mail server and security concerns, Web Server and security concern, firewall, Types of Intrusion, Symptoms that help in intrusion detection, statistical pattern recognition for detection and classification of attacks, vulnerabilities and Threats; Trojan Remote Access Trojan RAT, Virus, Worms and Malwares.

Data Collection Mechanism: Data Sampling, Packet Sampling, Flow Sampling, techniques for visualizing network data, Packet Sampling tools, Tcpdumpwindump, Wireshark tool, Writing Tcpdump/Windump Filters, libcap/winpcap libraries, pcap file, sniffing and spoofing tools, data and methodologies of computer intrusion detection, statistical & machine approaches to detection of attacks on computers.

Attacks and Packet analysis: network based attacks such as probes & denial of service attacks, host based attacks such as buffer overflows and race conditions, malicious codes, Examining Packet Header Fields, normal and abnormal values in IP, TCP, UDP, and ICMP header fields, Fragmentation theory, packet capture examples, fragmentation-based attacks, ICMP protocol, ICMP based attacks, Network Traffic Analysis: malicious, normal and application traffic; discern malicious traffic from false positives. IDS Patterns, DoS attacks, network mapping, and coordinated attacks, Indications & Warnings and Traffic Correlation, Network correlation, Network Situational Awareness, anomaly detection, signature based analysis, Semantic aware signature, policy based analysis, and host based analysis

IDS infrastructure: IDS Architecture, IDS/IPS Management and Architecture Issues with regard to deploying IDS/IPS systems, end point approach to security, system approach to security, IDS Interoperability models: CIDF (Common Intrusion Detection Framework), IDMEF (Intrusion Detection Message Exchange Format), IODEF (Incident Object Description Exchange Format), CVE (Common Vulnerabilities and Exposures), OVAL (Open Vulnerability and Assessment Language)

Protocol Analysis: Microsoft Protocols, SMB/CIFS, RPC, and Active Directory protocols, SIP protocol, Chat protocol, the key differences between IPv4 and IPv6, IPv6 based attacks

IDS tools: Snort and Bro IDS tools, NIDS Evasion, Insertion, and Checksums to confuse NID systems, Snort Fundamentals and

Configuration, Snort GUIs & Sensor Management, Snort Performance, Active Response & Tagging, Snort Rules, Stimulus Response, hosts response to both normal and abnormal traffic, Advanced Snort Concepts as rule ordering and reduction of false negatives and positives. Evaluation and tuning of IDS, Cross over Rate (CER) of IDS.

Advanced topics: honeypots, shadow honeypots.

Books and References

1. Stephen Northcutt and Judy Novak , Network Intrusion Detection", 3rd edition by. ISBN: 0735712654.
2. Extrusion Detection: Security Monitoring for Internal Intrusions By Bejtlich, Pearson Education.
3. Guide to Intrusion Detection and Prevention Systems (IDPS) Recommendations: Recommendations of the National Institute of Standards and Technology by Karen Scarfone and Peter Mell.
4. IETF RFC/RFP/standards related to Intrusion detection.
5. CCNP Security: Intrusion Prevention and Intrusion Detection Systems. By David Burns, OdunayoAdesina, Keith Barker, Cisco Press.
6. Intrusion Detection and correlation: challenges and solutions: by Christopher Kruegel, Fredrik Valeur, Giovanni Vigana, Advances in Information Security Volume 14, ISBN 0-387-23398-9 2005 Springer

CSE-712 Information Theory and Coding L-T-P-C: 3-0-0-3

Introduction to information Theory, Information and entropy, properties of entropy of a binary memory less source, Measure of Information, Source Coding, Shannon Fano coding, Huffman coding, Lempel Ziv coding , channel coding, Channel capacity, noisy channel coding theorem for DMC. Linear block codes, generator matrices, parity check matrices, encoder syndrome and error detection minimum distance, error correction and error detection capabilities, cyclic codes, coding and decoding. Coding convolutional codes, encoder, generator matrix, transform domain representation state diagram, distance properties, maximum likelihood decoding, Viterbi decoding, sequential decoding, interleaved convolutional codes. Special topics in information theory and coding.

Books and References

1. R. Bose, Information Theory Coding and Cryptography, Tata McGraw Hill.
2. F. J. MacWilliams, N. J. A. Sloane, The Theory of Error Correcting Codes, Elsevier.
3. S. Roman, Coding and Information Theory, Springer.
4. R. J. McEliece, The Theory of Information and Coding, Cambridge Uinv Press.
5. T. M. Cover, J. A. Thomas, Elements of Information Theory, Wiley.

CSE-713 Game Theory L-T-P-C: 3-0-0-3

Basic Solution concepts and computational issues: Games, Old and New; Games Strategies, Costs and Payoff,; Basic Solution Concepts; Finding equilibria and Learning in Games. Refinement of Nash: Games with Turns and Sub game Perfect Equilibrium: Cooperative games, markets and their Algorithmic Issues. The Complexity of finding Nash Equilibria: Introduction, Is Lemke Howson algorithm, succinct representation of games. Graphical Games: Computing Nash equilibria in Tree Graphical Games, Graphical Games and correlated Equilibria, Cryptography and Game theory: Cryptographic notation and settings, game theory notation and settings, cryptographic influence on game theory and Game theoretic influence on cryptography. Distributed algorithmic mechanism design : two examples of DAMD, Interdomain routing Cost sharing. Incentive and Pricing in Communication Networks Large network Competitive model, Pricing and Resource allocation Game theoretic model Incentive and Information security: Misaligned incentive Informational Asymmetries, Complex network and topology. Special topics in game theory.

Books and References

1. M. J. Osborne & A. Rubinstein, A Course in Game Theory, MIT Press.
2. M. J. Osborne, An Introduction to Game Theory, Oxford University Press.
3. N. Nisan, T. Rougharden, E. Tardos & V. V. Vazirani, Algorithmic Game Theory, Cambridge University Press.
4. K. Binmore, Fun and Games: A text on Game theory, AIBS publisher.

CSE-714 Bioinformatics L-T-P-C: 3-0-0-3

Introduction; Databases mapping, sequence, structure, non redundant; Sequence alignment pair wise and multiple; phylogenetics; Structure prediction methods homology, threading, abinitio; Sequence analysis class and secondary structure prediction; motifs PROSITE; detecting functional sites in DNA; OR Finder; Computer science perspective pattern recognition, hidden Markov models; Data Mining using Soft computing Techniques. Special topics in bioinformtatics.

Books and References

1. D. Baxevanis & B. F. F. Ouellette, Bioinformatics, Wiley Interscience.
2. M. Lesk, Introduction to bioinformatics, OXFORD University Press.
3. S. L. Salzberg, D. B. Searls and S.Kasif eds, Computational methods in molecular biology, Elsevier.
4. R. F. Doolittle, Computer methods for macromolecular sequence analysis, Academic Press.
5. M. Bishop, Guide to human genome computing, Academic Press.

CSE-715 Biometric Security L-T-P-C: 3-0-0-3

Security via biometrics, space domain based biometrics and recognition techniques. Correlation based biometric filters, Basic theory of correlation filters, Design of advanced correlation filters that offer tolerance to expected impairments, methods to implement digital correlation, applications of correlation filters. Special topics in biometric security.

Books and References

1. P. Reid, Biometrics for Network Security, Pearson Press.
2. J. D. Woodward, N.M.Orlans, P.T.Higgins, Biometrics, Dreamtech Publishers.
3. S. Nanavati, M. Thieme, R. Nanavati, Biometrics, Wiley Publishers

CSE-716 Soft Computing L-T-P-C: 3-0-0-3

Introduction to Neorofuzzy and Soft Computing, Fuzzy set theory, Fuzzy Rules, Fuzzy Reasoning, Fuzzy inference System, Neural Networks; Radial basis and recurrent neural networks, Hopfield Networks, Comparision of RBF and MLP Network, Running Algorithms, NeuroFuzzy Modeling, Applications of Soft Computing to Signal Processing, Image Processing, Forecasting, XOR Problem traveling salesman problem, Image compression suing MLPs character retrieval using Hopfield networks, Introduction to Genetic Algorithm hybrid systems etc. Recent advances in soft computing applications.

Books and References

1. V. Kecman, Learning and Soft Computing, Pearson.
2. D. E. Goldberg, Genetic Algorithms in Search Optimization and Machine Learning, Addison Wesley.
3. B. Kosko, Neural Network and fuzzy systems, Prentice Hall of India.
4. S. Goonatilake & S. Khebbal, Intelligent Hybrid Systems, Wiley.

CSE-717 Cluster and Grid Computing L-T-P-C: 3-0-0-3

Introduction: High Performance Computing (HPC), Grand Challenge Problems Computational and communication intensive, Parallel Architectures Classifications SMP,MPP, NUMA, Clusters and Components of a Parallel Machine, Conventional Supercomputers and it's limitations, Multi processor and Multi Computer based Distributed Systems. Cluster and Grids: Cluster Components Processor/machine, High Speed Interconnections goals, topology, latency, bandwidth, Example Interconnect: Myrinet, Inifiniband, QsNet, Fast Ethernet, Gigabit

Ethernet, Light weight Messaging system/Light weight communication Protocols, Cluster Middleware Job/Resource Management System, Load balancing, Scheduling of parallel processes, Enforcing policies, GUI, Introduction to programming tools such as PVM, MPI, Cluster Operating Systems Examples: Linux, MOSIX, CONDOR, Characteristics of Grid, Computational services, Computational Grids, Data grids/Storage grids, management and applications, Different components of Grid Grid fabric, Grid middleware, Grid applications and portal, Globus toolkit Ver.2.4, web services, MDS,GRAM, Grid Security –Cryptography, Authentication, Integrity, Digital Signature, Digital Certificates, Certificate Authority, MD 5, RSA, GSI,GSSAPI, Directory Service, LDAP,GRID FTP,GASS Fault Tolerance: Fault detection and diagnosis of Clusters and Grids. Recent advances in cluster and grid computing.

Books and References

1. D. Janakiram, Grid Computing, Tata Mcgraw Hill.
2. R. K. Buyya, High Performance Cluster Computing: Programming and Applications, Vol 2, PHI, NJ, USA.
3. P. Jalote, Fault Tolerance in Distributed Systems, Prentice Hall.
4. J. J. Jos & R. K. Buyya, High Performance Cluster Computing: Architecture and Systems, Vol 1, PHI, NJ, USA.
5. R. K. Buyya & C. Szyperski, Cluster Computing, Nova Science, New York, USA.
6. R. K. Buyya & K. Bubendorfer, Market oriented Grid and Utility Computing, Wiley.
7. J. Jaseph & C. Fellenstein, Grid Computing, Pearson.

CSE-718 Embedded Systems L-T-P-C: 3-0-0-3

Introduction: Embedded system, Processor, hardware units, software embedding, SOC, NOC, VLSI circuit; Device and Device drivers, I/O devices, timer and counting devices, serial communication using IC, LAN and advanced I/O buses between the networked multiple devices, Host system, parallel communication using ISA, PCI, PCI X, and advanced buses, device drivers, parallel port device drivers in a system, serial port device drivers. Interrupt service handling mechanism; Software and programming concepts: processor and memory selection for embedded system, embedded programming in C++, Java and UML, multiple processes and applications, problem of sharing data by multiple tasks and routines, interprocess communication; Real time OS: OS services, I/O subsystem, Network OS, Real time Embedded system, Need of well tested and debugged RTOS, Introduction to C/OS II.
Case Studies of programming with RTOS: Smart card embedded system, Hardware and Software co design: specification and design of an embedded system, use of software tools for development of an embedded system. Recent advances in embedded applications.

Books and References

1. R. Kamal, Embedded System Architecture, Programming and Design, Tata McGraw Hill.
2. R. Niemann, Hardware Software Codesign of Embedded System, Kulwer Academic.
3. S. V. Iyer & P. Gupat, Embedded Real Time System Programming, Tata McGraw Hill.
4. W. Wolf, Computer as Components: Principles of Embedded Computer System Design, Elsevier.
5. S. Heath, Embedded System Design, Elsevier.
6. R. Mall, Real Time Systems Theory and Practice, Pearson.
7. F. Vahid & T. Givargis, Embedded Ssytem design: A unified Hardware/Software approach, Wiley.
8. G. D. Michelli & L. Benin, Network on Chip, Morgan & Kaufman Publication.

CSE-719 Fault Tolerant Computing L-T-P-C: 3-0-0-3

Introduction to Fault Tolerant Computing. Basic concepts and overview of the course; Faults and their manifestations, Fault/error modeling, Reliability, availability and maintainability analysis, System evaluation, performance reliability trade offs. System level fault diagnosis, Hardware and software redundancy techniques. Fault tolerant system design methods, Mobile computing and Mobile communication environment, Fault injection methods, Software fault tolerance, Design and test of defect free integrated circuits, fault modeling, built in self test, data compression, error correcting codes, simulation software/hardware, fault tolerant system design, CAD tools for design for testability. Information Redundancy 23
and Error Correcting Codes, Software Problem. Software Reliability Models and Robust Coding Techniques, Reliability in Computer Networks Time redundancy. Re execution in SMT, CMP Architectures, Fault Tolerant Distributed Systems, Data replication. Case Studies in FTC: ROC, HP Non Stop Server. Case studies of fault tolerant systems and current research issues.

Books and References

1. D. K. Pradhan, editor, Fault Tolerant Computer System Design, Prentice Hall.
2. I. Koren. Fault Tolerant Systems, Morgan Kauffman.
3. L. L. Pullum, Software Fault Tolerance Techniques and Implementation, Artech House Computer Security Series.
4. M. L. Shooman, Reliability of Computer Systems and Networks Fault Tolerance Analysis and Design, Wiley.

CSE-720 Parallel Algorithms L-T-P-C: 3-0-0-3

Modeling; Synchronous Network Model, Leader Election in a Synchronous Ring, Algorithms in General Synchronous Networks, Distributed Consensus with Link Failures, Distributed Consensus with Process Failures, More Consensus Problems, Asynchronous System Model, Asynchronous Shared Memory model, Mutual Exclusion, Resource Allocation, Consensus, Atomic Objects, Asynchronous Network Model, Basic Asynchronous Network Algorithms, Synchronizers, Shared Memory versus Networks, Logical Time Global Snapshots and stable properties, Network Resource allocation, Asynchronous Networks with Process Failures, Data Link Protocols, Partially Synchronous Models, Mutual Exclusion with Partial Synchrony, Consensus with Partial Synchrony. Recent advances in parallel algorithms.

Books and References

1. B. Wilkinson & M. Allen, Parallel Programming, Pearson.
2. M. J. Quinn, Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill.
3. W. Groop, E. Lusk & A. Skjellum, Using MPI: Portable Parallel Programming with the Message passing Interface, MIT Press.
4. H. F. Jordan and G. Alaghband, Fundamentals of Parallel Processing, Pearson.
5. G. V. Wilson & G. Wilson, Practical Parallel Programming, MIT Press.

CSE-721 Performance Evaluation of Computer System L-T-P-C: 3-0-0-3

Introduction to Probability Refresher: Bayes theorem, Conditional probability, Total probability, Discrete and Continous Random variables, Common distributions, Probability Generating Functions(PGF) and Laplace Transforms(LST), Numerous examples from computer networking, Stochastic processes, Discrete time Markov chains (DTMC), Continous time Markov chains (CTMC), Queueing systems (M/M/1, M/M/c/k, M/G/1), Queueing networks, Statistical analysis of simulations, Specific topics: Introduction to performance measures, basic probability review, Markov chains, basic queueing models, introduction to simulation modeling, some advanced queueing models, basic queueing networks, examples from recent research papers.

Books and References

1. Kishor Trivedi , Probability and Statistics with Reliability, Queueing and Computer Science Applications, PHI.
2. Law and Kelton, Simulation Modeling and Analysis, 2nd Ed., McGraw Hill.
3. D. Gross and C. M Harris, Fundamentals of Queueing Theory, John Wiley and Sons.
4. L. Kleinrock , Queueing Systems Vol. I & II, John Wiley and Sons.
5. A gentle introduction to some basic queuing concepts, by William Stallings, PHI.
6. Quantitative Systems Performance, an on line version of the book on queueing networks by Edward D. Lazowska, John Zahorjan, G. Scott Graham, Kenneth C. Sevcik.

CSE-722 Speech and NLP L-T-P-C: 3-0-0-3

Introduction; Brief Review of Regular Expressions and Automata; Finite State Transducers; Word level Morphology and Computational Phonology; Basic Text to Speech; Introduction to HMMs and Speech Recognition. Indian language case studies; Part of Speech Tagging; Parsing with CFGs; Probabilistic Parsing. Representation of Meaning; Semantic Analysis; Lexical Semantics; Word Sense; Disambiguation; Discourse understanding; Natural Language Generation; Techniques of Machine Translation; Indian Language case studies.

Books and References

1. Daniel Jurafsky and James H.Martin, Speech and Language Processing, Prentice Hall
2. Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, NLP: A Paninian Perspective, Prentice Hall, New Delhi.
3. T. Winograd. Language as a Cognitive Process, Addison-Wesley.

CSE-723 Advances in Compiler Construction L-T-P-C: 3-0-0-3

Review of compiler fundamentals - lexical analysis, parsing, semantic analysis, error recovery and intermediate code generation; Runtime storage management; Code generation; Code improvement - peephole optimization, dependence analysis and redundancy elimination, loop optimization, procedural and inter-procedural optimization, instruction scheduling, optimization for memory hierarchy; Compilation for high performance architecture; Portability and retargetability; Selected topics from compilers for imperative, object-oriented and mark-up languages, parallel and distributed programming and concurrency.

Books and References

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley.
2. Michael L. Scott, Programming Language Pragmatics, Elsevier.
3. Andrew W. Appel, Modern Compiler Implementation in C/Java, Cambridge University Press.
4. Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier.
5. Allen I. Holob, Compiler Design in C, Prentice-Hall.
6. Steven S. Muchnik, Advanced Compiler Design and Implementation, Elsevier.
7. Randy Allen and Ken Kennedy, Optimizing Compilers for Modern Architectures, Elsevier.

CSE-724 Formal Methods in Secure Computing L-T-P-C: 3-0-0-3

Decidability of security, Access control, take grant model, SPM, Expressive power of models, typed access control models Authentication and key establishment, Freshness, general design principles, common attacks, forward secrecy, multiparty authentication, Anonymity Protocol Verification and Correctness, Logic based Models, BAN Logic, Spi calculus Strand space based analysis, Applicability to group protocols.

Books and References

1. Willis H Ware, Charles P Pfleeger, Shari Lawrence Pfleeger, Security in Computing , Prentice Hall.
2. Theo Dimitrakos, Fabio Martinelli Formal Aspects In Security And Trust: Springer.
3. Computer Security Handbook, Seymour Bosworth, M E Kabay, John Wiley.
4. W. Mao, Modern Cryptography: Theory & Practice, Pearson Education.

CSE-750 Modeling & Simulation L-T-P-C: 3-0-0-3

Nature of Simulation. Systems , Models and Simulation, Continuous and Discrete Systems, system modeling, concept of simulation, Components of a simulation study, Principles used in modeling ,Static and Dynamic physical models, Static and Dynamic Mathematical models Introduction to Static and Dynamic System simulation
Types of System Simulation, Different Methods and Models for simulation, system simulation languages ,Hybrid simulation, Real Time simulations.
Representation of Time Delays. Discrete and Continuous probability functions, Poisson arrival patterns, Exponential distribution, Service times, Normal Distribution Queuing Disciplines, Simulation of single and two server queue. Application of queuing theory in computer system. Discrete Events ,Generation of arrival patterns ,Simulation programming tasks, Gathering statistics, Measuring occupancy and Utilization, Recording Distributions and Transit times. Study of GPSS, SIMSCRIPT.

Books and References

1. Gorden G., System simulation, Prentice Hall.
2. Seila, Simulation Modeling, Cengage Learning.
3. Law,Simulation Modeling And Analysis, McGraw Hill.
4. Deo, System Simulation with Digital Computer, PHI
5. Harrington, Simulation Modeling methods, McGraw Hill.

CSE-751 Computer Graphics L-T-P-C: 3-0-0-3

Overview of computer graphics: representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model.
Geometry and Generation of Simple Primitives: Line generation algorithms, Circle generation algorithms, Character generation and Ellipse generation
Graphical Devices: Input Devices, Display devices
Scan Converting Polygons: Raster displays and Vector displays, Algorithms to scan convert polygons
Two Dimensional Transformations: Translation, Scaling, Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Rotation, Reflection Shear
Windowing and Clipping: Line clipping algorithm, Polygon clipping algorithm, Windowing and Viewing Transformations
Three Dimensional Fundamentals: Projections, Representation of Polygonal Net, Transformations
Hidden Surfaces and Lines: Z –Buffer algorithm, Scan Line algorithm, Painter's algorithm, Sub –division algorithm
Light, Colour and Shading: Illumination, Shadows, Transparency and Colour, Shading Algorithm, Ray tracing, Halftones
Animation: Design of Animation Sequences, Animation Functions, Raster Animations and Animation Languages, Key-Frame Systems, Motion Specification
Curve and Surfaces: Parametric Functions and Properties of Curves, Bezier Curves and B-Spline Curves

Books and References

1. Donald Hearn & M Pauline Baker, "*Computer Graphics*", Pearson Education.
2. Newman, W M and Sproull R F, "*Principles of Interactive Computer Graphics*", McGraw Hill, Tokyo.
3. Alan Watt, "*3D Computer Graphics*", Addison Wesley.
4. Foley, Vandam, Feiner, Hughes – "Computer Graphics principles, Pearson Education.
5. F S Hill, "*Computer Graphics Using Open GL*", Pearson Education.