

**Scheme of Teaching and Examination for
Master of Engineering (Computer Science and Engineering)
Two years Full time Course**

Semester-I										
Subject Code	Subject	Hours per week			Scheme of Examination	Credits	Theory	IA	Pract	Total
		L	T	P						
MCSE 1.1	Advance Data Structure and Algorithm	3	1	-	3	4	2	-	6	
MCSE 1.2	Distributed Operating System	3	1	-	3	4	2	-	6	
MCSE 1.3	Advances in Computer Architecture	3	1	-	3	4	2	-	6	
MCSE 1.4	Elective-I	3	1	-	3	4	2	-	6	
MCSE 1.5	Elective –II	3	1	-	3	4	2	-	6	
MCSE 1.6	Programming Lab-I	---	--	4	--	-	2	2	4	
Total		15	5	4		20	12	2	34	

Semester-II										
Subject Code	Subject	Hours per week			Scheme of Examination	Credits	Theory	IA	Pract	Total
		L	T	P						
MCSE 2.1	Advanced Concepts in Database System	3	1	-	3	4	2	-	6	
MCSE 2.2	Design and Analysis of Computer Networks	3	1	-	3	4	2	-	6	
MCSE 2.3	Advanced Software Engineering	3	1	-	3	4	2	-	6	
MCSE 2.4	Elective-III	3	1	-	3	4	2	-	6	
MCSE 2.5	Elective –IV	3	1	-	3	4	2	-	6	
MCSE 2.6	Programming Lab -II	---	--	4	-	-	2	2	4	
Total		15	5	4		20	12	2	34	

Semester-III										
Subject Code	Subject	Hours per week			Scheme of Examination	Credits	Theory	IA	Pract	Total
		L	T	P						

						Theory	IA	Pract	Total
MCSE 3.1	Advanced Compiler Design	3	1		3	4	2	-	6
MCSE 3.2	Elective-V	3	1		3	4	2	-	6
MCSE 3.3	Project	---	---	12	---	---	4	4	8
MCSE 3.4	Seminar	---	---	8	---	---	2	2	4
	Total	6	2	20		8	10	6	24

Semester-IV										
Subject Code	Subject	Hours per week			Scheme of Examination	Credits	Theory	IA	Oral*	Total
		L	T	P						
MCSE 4.1	Dissertation	--	----	24	--	--	10	12	22	
	Total			24		---	10	12	22	

Grand Total of all four semesters	36	12	52		48	44	22	114
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All theory papers of 100 marks

Note:- * Examination panel shall be constituted with the Head of Computer Engineering Department or his nominee (if Head is the guide or if the Head cannot be present) as a chairman, , the guide and another examiner from outside the University , wherever possible.

Elective Lists:

<p>ELECTIVE –I (MCSE 1.4)</p> <ul style="list-style-type: none"> i. Machine Learning ii. Stochastic modeling and Analysis iii. Advanced Digital Signal Processing iv. Software Testing and Quality Assurance v. Graph Theory <p>ELECTIVE-III (MCSE 2.4)</p> <ul style="list-style-type: none"> i. Pattern Recognition ii. Advanced Genetic Algorithm iii. Web Technology and E-commerce iv. Embedded System v. Functional Programming <p>ELECTIVE –V (MCSE 3.2)</p> <ul style="list-style-type: none"> i. Fuzzy Logic Design ii. Cryptography and Network Security iii. Object Oriented Modeling and Design iv. Robotics v. Multi Core Architecture 	<p>ELECTIVE-II (MCSE 1.5)</p> <ul style="list-style-type: none"> i. Advanced Computer Graphics ii. Storage Area Network iii. Parallel Computing iv. Algorithmic approach to Bio-informatics v. Data Mining <p>ELECTIVE –IV (MCSE 2.5)</p> <ul style="list-style-type: none"> i. Image Processing ii. Mobile Computing iii. Grid and Cluster Computing iv. Real Time System v. Information Storage and Retrieval
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SEMESTER I

MCSE1.1 ADVANCED DATA STRUCTURES AND ALGORITHMS

Algorithm Analysis : Mathematical Background, Running Time computation.
Abstract Data Types (ADTs), The List ADT, The Stack ADT, The Queue ADT.
Binary Trees, The Search Tree ADT-Binary Search Trees, AVL Trees, Splay Trees, Tree Traversals, B-Trees. Hash Function, Separate Chaining, Hash Tables Without Linked Lists, Rehashing, Extendible Hashing. Binary heaps, Binomial Heap and Fibonacci Heaps..
Sorting techniques. A General Lower Bound for Sorting. External Sorting techniques.
Topological Sort, Shortest-Path Algorithms, Network Flow Problems, Minimum Spanning Tree, Applications of Depth-First Search and Breadth first search.
NP-Hard and NP-complete problems. Greedy Algorithms, Divide and Conquer, Dynamic Programming, Randomized Algorithms, Backtracking Algorithms
Advanced Data Structures like Top-Down Splay Trees, Red-Black Trees, Deterministic Skip Lists, AA-Trees, Heaps, k-d Trees, Pairing Heaps

Text Books:

1. Mark Allen Weiss, 2009, "Data Structures and Algorithm Analysis in C++", 3rd edition, Pearson Education
2. Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein, 2008, "Data Structures Using C", Eastern Economy Edition
3. Michael Garey and David Johnson, Computers and Intractability, A guide to the theory of NP-Completeness, W.H. Freeman and Company, New York, 1999

Reference Books

1. T. H. Cormen, C.E. Leiserson, R. L. Rivest, C. Stein, "Introduction to Algorithms ", Prentice Hall of India, 2001.
2. G. Brassard and Bratley, Fundamentals of Algorithmic, Prentice. Hall 1996.
3. Sara Baase, Allen Van Gelder, "Computer Algorithms: Introduction to design and Analysis ", Addison Wesley, 2000.

MCSE1.2 DISTRIBUTED OPERATING SYSTEM

Multiprocessor operating system - Multiprocessor system architecture, structure, processor scheduling and allocation, memory management.
Distributed operating system- characteristics - Design issues communication models – clock synchronization - Mutual exclusion Election Algorithms.
Distributed Deadlocks detection - Distributed scheduling - Distributed File system -

Distributed shared memory. Multimedia Files, Video compression, Process Scheduling, File System, File placement, Caching, Disk Scheduling.

Real Time Operating System: Scheduling mechanisms, Interrupts, Memory management, I/O & networking, resource reservation.

Case studies: Open source software, LINUX, Open SOLARIS

Text Books:

M Singhal and NG Sivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Inc., 2001

Reference Books

1. A.S. Tanenbaum, Distributed Operating system, Pearson Education Asia, 2001.
2. Silberschatz and Galvin, Operating System Concepts, VI edition, Addison Wesley, 2006

MCSE1.3 ADVANCES IN COMPUTER ARCHITECTURE

Introduction Computer Design: Trends in Technology; Trends in power in Integrated Circuits; Trends in cost; Dependability, Measuring, reporting and summarizing. Quantitative Principles of computer design; Performance and Price-Performance.

Types of Parallelism. Case study of Pentium 4.

Memory Hierarchy Design, Storage Systems , Case study of AMD Opteron memory hierarchy;. Storage Systems design and analysis.

Hardware and Software for VLIW and EPIC Exploiting Instruction-Level Parallelism statically, Detecting and Enhancing Loop-Level Parallelism, Scheduling and Structuring Code for Parallelism, Hardware Support for Exposing Parallelism: Predicated Instructions, Hardware Support for Compiler Speculation, The Intel IA-64 Architecture and Itanium Processor..

Large-Scale Multiprocessors and Scientific Applications: Interprocessor Communication: Performance of Scientific Applications on Shared-Memory Multiprocessors and Performance Measurement. Implementing Cache Coherence,

Computer Arithmetic : Floating Point, Floating-Point Multiplication, Floating-Point Addition, Division and Remainder, More on Floating-Point Arithmetic, Speeding Up Integer Addition, Speeding Up Integer Multiplication and Division.

Text Books:

Kai Hwang: Advanced Computer Architecture - Parallelism, Scalability, Programmability, 2nd Edition, Tata McGraw Hill, 2010.

Reference Books

Hennessey and Patterson: “Computer Architecture A Quantitative Approach”, 4th Edition, Elsevier, 2007.

ELECTIVE –I (MCSE1.4)

MCSE1.4.1 MACHINE LEARNING

Learning problems, Designing a learning system, Issues in machine learning.

Concept Learning, Finding a maximally specific hypothesis, Version Spaces, candidate elimination algorithms, Inductive bias.

Decision Tree Representation, Decision Tree Learning Algorithms, hypothesis space search, Inductive bias and issues in decision tree learning.

Bayesian Learning, Concept learning through Bayes Theorem, Maximum Likelihood and Least squared error hypothesis, Minimum Description Length principle, Bayes Optimal classifier, Gibbs Algorithm, Naïve Bayes classifier, Bayesian belief network,

Theoretical Approaches: inductive Inference , Grammatical Inference PAC Learning . Complexity of Learning , polynomial learnability , VC-dimension

Application of Machine learning to data mining and knowledge discovery.

Text Books:

Tom Mitchell, Machine Learning, McGraw Hill Inc, 1997

Reference Books:

1 Anthony ,M. and Biggs , N. ,Computational Learning Theory , Cambridge 1992.

2. Ross Q. J : Program for machine learning , Morgan Kaufmann 1997

3. Hastie, Tibshirani, Friedman The elements of Statistical Learning Springer Verlag.

4. Pattern recognition and machine learning by Christopher Bishop, Springer Verlag

MCSE1.4.2 STOCHASTIC MODELLING AND ANALYSIS

Probability Preliminary: Axiomatic approach of probability, Random variable- characteristics- mean, variance, distribution function, E and V- operators, moment generating function (MGF) and characteristic function, function of multi-dimensional random variable

Probability distributions:

Discrete distributions: Binomial, Pascal, and Poisson- establishment and analysis

Continuous distributions: Exponential, normal, lognormal, gamma and Weibull distributions- establishment – establishment and analysis- properties and limiting form, approximations

Sampling Theory, Random Samples, Sampling Distributions, Estimation of parameters, Test of hypotheses on the Mean, Type I error, Type II Error, Test of Hypothesis on the equality of Two Means, Test of Hypothesis on a variance, Test of Hypothesis on the Equality of Two variances. Goodness of fit test

Pure birth process, Assumptions, derivation; birth and death queuing models- single and multiple server queuing models- queues with finite waiting- finite source models, steady state measures

Markov Chains – Introduction, Transition Probabilities, Homogeneous Markov Chains, Transition Probability Matrix, Initial Distribution, Absorbing States, Communication between States, Irreducible Markov Chains, Steady State Vector.

Limitations of Markov process, Semi-Markov chains- establishment, transformation, system effectiveness prediction, Hidden Markov models (conceptual treatment) with selected applications restricted to Engg.

Text Books:

1. William W. Hines & Douglas C. Montgomery (2002), *Probability and statistics in Engg and management science*, John Wiley & Sons, 4th edition.
2. Kishor S. Trivedi (2000), *Probability and Statistics with Reliability, Queuing and Computer Science Applications*, Prentice Hall of India,
3. Sheldon M. Ross (2007), *Introduction to Stochastic processes*, Academic Press, USA, 9th edition.

References:

1. Przemyslaw Dymarski (Ed.), *Hidden Markov models- Theory and applications*, InTech Pub., Russia
2. Sheldon M. Ross (2009), *Introduction to Probability Models*, 10th Edition, Academic Press, USA,
3. E. E. Lewiss- *Introduction to reliability engineering- John Wilely & Sons*, New York, 1987.
4. Geoffrey R. Grimmet, David R. Stirzaker (2001), *Probability and random processes*, Oxford Press, USA, 3rd Edition

MCSE1.4.3 ADVANCED DIGITAL SIGNAL PROCESSING

The Discrete Fourier Transform: Its Properties and Applications Properties of the DFT: Linear Filtering Methods Based on the DFT: Use of the DFT in Linear Filtering, Filtering of Long Data Sequences. Frequency Analysis of Signals using the DFT.

Efficient Computation of the DFT: Fast Fourier Transform Algorithms , Divide-and-Conquer Approach to Computation of the DFT, Radix-2 FFT Algorithms, Radix-4 FFT Algorithms, Split-Radix FFT Algorithms, Implementation of FFT Algorithms. Applications of FFT Algorithms: The Goertzel Algorithm.

Implementation of Discrete- Time Systems: Structures for the Realization of Discrete-Time Systems. Digital Filters: Design of Digital Filters, analysis of filters, application

Text Books:

John G. Proakis and Dimitris G. Manolakis , *Digital Signal Processing*, Pearson Education/PHI, Third Edition 2003.

Reference Books

1. Paulo S. R. Diniz, Eduardo A. B. da Silva And Sergio L. Netto, *Digital Signal Processing: System Analysis and Design*, Cambridge University Press, 2002.
2. Sanjit K.Mitra , *Digital Signal Processing: A Computer Based Approach*, Tata McGraw-Hill Edition 2001.
3. Alan V.Oppenheim and Ronald W.Schafer, *Digital Signal Processing*, Pearson education/PHI, 2003

MCSE1.4.4 SOFTWARE TESTING AND QUALITY ASSURANCE

Evolution of Software as an engineering discipline. Maturity of Software development Technology, Software life cycle, Software process models Requirement Engineering and Analysis. System Models, Requirement definition and .specification

Function Oriented Design, Module level Concept, Design notation and Specification. Structured Design Methodology verification. Metrics, Design for Object Oriented System, system design process, Object design process, Design Patterns. Project Management, Configuration Management, Managing People.. Software cost estimation

Software Development tools, Computer aided Software Engineering, CASE work benches. Quality Management, Process improvement. Testing fundamentals, various testing mechanisms, white box testing, Basis path testing, Block box testing. Software Testing Strategies: Unit testing, Integration testing, Art of Debugging Software Reliability, Programming for Reliability

Text Books:

1. Pankaj Jalote: An integrated approach to Software Engineering, 8th Ed.
- 2 .Lan Sommcville: Software Engineering 7th Ed.

Reference Books

Roger Presaman: Software Engineering A Practitioner's approach 5th Ed.

MCSE1.4.5 GRAPH THEORY

Graph, Sub Graph , Connected component , spanning trees , Shortest path algorithm
Cut-sets and Cut-Vertices: Cut-Sets, Properties of Cut-sets, All Cut-sets in a Graph, Fundamental Circuits and Cut-Sets, Connectivity and Separability, Network flows, 1-isomorphism, 2-isomorphism. Combinatorial Vs. Geometric Graphs, Planar Graphs, Kuratowski's Two Graphs, Different Representations of a Planar Graph, detection of planarity, Geometric Dual, Combinatorial Dual. Matrix Representation of Graphs. Chromatic Number, Chromatic Partitioning, Chromatic Polynomial, Matching, Coverings. The Four Color Problem. Types of Enumeration, Counting Labeled Trees, Counting Unlabeled Trees, Polya's Counting Theorem, Graph Enumeration with Polya's Theorem. Shortest-path Algorithms, Depth First Search on a Graph, Isomorphism, Performance of Graph-Theoretic Algorithms, Graph-Theoretic Computer Languages, Graphs in Coding Theory.

Text Books:

Graph Theory with Applications to Engineering and Computer Science, Narasingh Deo, PHI.

Reference Books

1. Graph Theory and Combinatorics, Dr. D.S. Chandrasekharaiah, Prism, 2005.
2. Introduction to Graph Theory, Chartrand Zhang, TMH, 2006.
3. .Graph Theory Modeling, Applications, and Algorithms, Geir Agnarsson & Raymond Geenlaw, Pearson Prentice Hall, 2007.

ELECTIVE II (MCSE1.5)

MCSE1.5.1 ADVANCED COMPUTER GRAPHICS

Elements of pictures created in computer graphics, graphics display devices, Basic raster graphics algorithms for drawing 2D primitives: Midpoint line & circle drawing algorithm, scan-line polygon filling algorithm, antialiasing.,

2D transformation matrix representations and homogeneous coordinates, composite transformations, window-to-view port coordinate transformation, clipping operations- Cohen Sutherland line clipping, Sutherland-Hogeman polygon clipping, 3D object representations: polygon surfaces, curved lines and surfaces, quadric surfaces, spline representations, Bezier curves and surfaces, B-spline curves and surfaces

The OpenGL API; Color; Viewing; Control functions; Polygons and recursion; The three-dimensional gasket; Plotting implicit function. Display lists; Programming event-driven input; Design of interactive programs; Classical and computer viewing; Projections in OpenGL; Hidden-surface removal; Interactive mesh displays; Parallel/ Perspective-projection matrices; The Phong lighting model; Polygonal shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global illumination.

Text Books:

1. Interactive Computer Graphics A Top-Down Approach with OpenGL -Edward Angel, 5th Edition, Addison-Wesley, 2008.
2. Computer Graphics – James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Addison-wesley 1997.

Reference Books:

1. Computer Graphics - OpenGL Version – Donald Hearn and Pauline Baker, 2nd Edition, Pearson Education, 2003
2. Computer Graphics Using OpenGL – F.S. Hill,Jr. 2nd Edition, Pearson Education, 2001.

MCSE1.5.2 STORAGE AREA NETWORKS

Server Centric IT Architecture and Storage – Centric IT Architecture. Replacing a server with Storage Networks The Data Storage and Data Access problem; Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; Network Attached Storage(NAS)Architecture, The NAS hardware/software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems.

Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network. SAN Architecture. Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; . Software Components of SAN The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs. Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Text Books:

- Ulf Troppens, Rainer Erkens and Wolfgang Muller: “Storage Networks Explained”, Wiley India, 2007

Reference Books:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2003.
2. Richard Barker and Paul Massiglia: "Storage Area Network

MCSE1.5.3 PARALLEL COMPUTING

The PRAM Model of Parallel Computation, PRAM algorithms- Parallel Reduction, Prefix sums, List ranking, Preorder Tree Traversal, Merging Two sorted Lists, Graph Coloring. Parallel Programming Languages- Programming Parallel Processes- An Illustrative example, A sample Application.

Matrix Multiplication - Algorithms for processor arrays – Matrix multiplication on The 2D –Mesh SIMD model and Shuffle-Exchange SIMD model, Algorithms for Multiprocessors, Algorithm for Multicomputer – Row- column Oriented Algorithms.

Solving Linear systems- Gaussian Elimination. Sorting- Enumeration sort, Lower Bounds on Parallel Sorting, Odd-Even Transposition Sort, Quicksort-Based Algorithms – Parallel Quicksort, Hyperquicksort.

Dictionary Operations- Complexity of Parallel Search, Searing on Multiprocessors- Ellis's Algorithm, Manber and Ladner's Algorithm. Graph Algorithms - Searching a Graph- P-Depth search, Breadth-Depth search, Breadth-First Search, Connected Components, All-Pairs Shortest Path, Single source shortest path.

Combinatorial Search- Introduction, Divide and conquer, Parallel branch and Bound Algorithms- Multiprocessor algorithms, Multicomputer Algorithms, Introduction to Parallel Programming with MPI and OpenMP

Text Books:

1. Michael j Quinn, 'Parallel Computing - Theory and Practice', TMH 2002
2. Michael J. Quinn." Parallel Programming in C with MPI and OpenMP", McGraw Hill (2003)

Reference Books:

1. Barry Wilkinson and Michael Allen. Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers (2nd Edition), Prentice Hall PTR (2005)
2. A. Grama, A. Gupta, G. Karypis and V. Kumar." Introduction to Parallel Computing " (2nd edition), Addison Wesley (2002)
3. H. El-Rewini and T.G. Lewis. " Distributed and Parallel Computing" Manning (1997)
4. .I. Foster. "Designing and Building Parallel Programs", Addison Wesley (1995)
4. Kai Hwang and Zhiwei Xu. Scalable Parallel Computing", McGraw Hill (1998)

MCSE 1.5.4:ALGORITHMIC APPROACHES TO BIO-INFORMATICS

A Primer in biology; Computational Problems arising in biology. Sequence alignment for DNA and Protein sequences. Sequence alignment for DNA and protein sequences Concepts: homology, sequence similarity and sequence alignment; dynamic programming algorithms. Pair wise alignment. Global and local alignment using dynamic programming. Heuristic alignment methods: BLAST/FASTA and the statistics of local alignments Multiple sequence alignment: Definition, scoring, techniques Aligners for proteins sequences Spliced alignment.

Motif finding in DNA and proteins Hidden Markov models (HMMs). The basic HMM algorithms: forward, backward, Viterbi, Baum-Welch Applications: CpG islands, gene finding, profile HMMs, pair HMMs

Genome assembly :Analysis of high-throughput sequencing data. Phylogenetic analysis. Why phylogeny? Neighbor joining, parsimony, and maximum likelihood methods

Comparative genomics: gene regulation, gene finding, genome rearrangements High throughput biological data: microarrays, mass spectrometry, and protein-protein interactions.

Text Books:

Neil C.Jones and Pavel A. Pevzner, 2004, An Introduction to Bioinformatics algorithms, MIT Press.

Reference Books

1. Fundamental Concepts in Bio-Informatics, Dan E. Krane and Michael L. Raymer, Benjamin Cummings publishers, 2003
2. Bioinformatics: the machine learning approach, *Baldi & Brunak* MIT press 2001

MCSE1.5.5 DATA MINING

Data Mining Tasks. Types of Data; Data Quality. Data Preprocessing; Measures of Similarity and Dissimilarity. General approach to solving a classification problem; Decision tree induction; Rule-based classifier; Nearest-neighbor classifier.

Problem Definition; Frequent Itemset generation; Rule Generation; Compact representation of frequent itemsets; Alternative methods for generating frequent itemsets. FP-Growth algorithm, Evaluation of association patterns; Effect of skewed support distribution; Sequential patterns. Cluster analysis, K-means Agglomerative hierarchical clustering,, Cluster Evaluation. Multidimensional analysis and descriptive mining of complex data objects; Spatial data mining; Multimedia data mining; Text mining; Mining the WWW. Outlier analysis. Spatio-temporal data set: analysis and pattern recognition.

Data mining applications, Data mining system products and research prototypes; Additional themes on Data mining; Social impact of Data mining; Trends in Data mining.

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar , Introduction to Data Mining, Pearson Education, 2007
2. Jiawei Han and Micheline Kamber, Data Mining – Concepts and Techniques , 2nd Edition, Morgan Kaufmann, 2006.

Reference Books

K.P.Soman, Shyam Diwakar, V.Ajay, Insight into Data Mining – Theory and Practice , PHI publishers, 2006.

MCSE 1.6: PROGRAMMING LAB – I

Students must undertake minimum of nine programming exercises such that the programming exercises cover the contents of each of subjects MCSE 1.1, MCSE 1.2 and MCSE 1.4.

SEMESTER II

MCSE2.1 ADVANCED CONCEPTS IN DATABASE SYSTEMS

Memory hierarchy - Data formats - file structures - Indexes -B-trees Hash tables – external sorting. Evaluation of relational operators - Algorithms. Normalization, Query optimization Use of Heuristics – Cost Estimations. Transaction concept - Schedules - Serializability. Concurrency control techniques: Timestamp based - Lock based - Optimistic - Multiversion. Guidelines for index selection - Clustering and indexing - Index tuning, Conceptual Schema tuning, Tuning queries and views.

Log based recovery - undo, redo, undo/redo - logging - Shadow paging - media recovery. Applications: Data Mining, Data warehousing, Web databases.

Text Books:

A.Silberschaiz, HF. Korth, S.Sudarshan, "Database System Concepts ", 3rd edition, McGraw Hill, 1997

Reference Books:

1 R. Elmasri and S. B. Navathe, "Fundamentals of Database System", 2nd edition, The Benjamin /Cummings Publishing Co., 1994.

2. C J Date, "Database an Introduction to Database Systems ", 8th edition, Addison Wesley, 2003.

MCSE2.2 DESIGN AND ANALYSIS OF NETWORK SYSTEM

Introduction to Networks -Application of Networks - Architecture Topology Switching - SLIP, PPP - ALOHA protocols, CSMA/CD, IEEE 802.3, 802.4, 802.5

Network Layer Issues- Routing, Congestion control- Internetworking - Issues, Address Learning Bridges, Spanning tree, Source routing, Bridges, Routers, Gateway.

Network Protocol- IP datagram - hop by hop routing, ARP, RARP, DHCP -Sub net Addressing, Address Masking, ICMP, RIP, RIPV2, OSPF, DNS, LAN and WAN Multicast.

Transport Layer- Design issues, Connection Management, Transmission Control Protocol (TCP) - User Datagram Protocol (UDP).

Application Layer Protocol- Telnet - TFTP - FTP - SMTP - Ping Finger, Bootstrap Network Time Protocol- SNMP.

Text Books:

1. A.S. Tanenbaum, "Computer Networks ", Fourth Edition, Prentice Hall India, 2003
2. Computer Networking, A Top-Down Approach Featuring the Internet, Third Edition, J.F. Kurose and K.W. Ross, Addison-Wesley, 2005.

Reference Books:

1. W Richard Stevens, "TCP/IP Illustrated -Volume I, The protocols ", Addison-Wesley Professional Computing Series, 1994.
2. *Computer Networks, A Systems Approach, Third Edition*, L. Peterson and B. Davie, Morgan Kaufman, 2003.
3. *Communication Networks, Fundamental Concepts and Key Architectures, Second Edition*, A. Leon-Garcia and I. Widjaja, McGraw-Hill, 2003.
4. *Computer Networks and Internets with Internet Applications, Third Edition*, D.E. Comer, Prentice-Hall, 2001.
5. *Data and Computer Communications, Eighth Edition*, W.S. Stallings, Pearson Prentice-Hall, 2007.

MCSE2.3 ADVANCED SOFTWARE ENGINEERING

Software Engineering Process, Project management, Process and Project metrics. Software estimation models. Risk analysis. Software project scheduling and Tracking. Requirement Engineering and its phases, Building the Analysis Models: Data Flow/ Control Flow Model, State Charts and Transition Models, Quality Function Deployment, Requirements Validation Metrics. Software Design Concepts and principles, Data Design, Software Architectural Styles Analysis and metrics of Architectural Designs, Design Structure. Quality Index Estimation, User interface design models and process Interface Design. Component Level Design and its metrics. Principles of Software Testing White-Box Testing Techniques/ Black-Box Testing Techniques and variants. Integration, Validation and System Testing, Debugging. Software Quality Assurance: Quality Metrics and Models, Software Reliability Theory, Software Maintenance Software Configuration Management - Reverse Engineering and Re-engineering, CASE Tools and Case Studies.

Text Books:

Roger Pressman. S., Software Engineering : A Practitioner s Approach, (4th Edition), MCH 2010.

Reference Books:

1. . I. Sommerville, Software Engineering, 9th Edition: Pearson Education, 2009.
2. Pfleeger, Software Engineering, Prentice Hall, 1999.
3. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli Fundamentals of Software Engineering, PHI 1991.

ELECTIVE III (MCSE2.4)

MCSE2.4.1 PATTERN RECOGNITION

Introduction to pattern recognition and application to OCR , speech recognition, fingerprints, signature etc. Commercial importance of application. Statistical Pattern Recognition : Pattern and classification , discriminate function , Bayes decision rule, nearest neighbor rule , probability of error. Linear discriminant functions: Perceptrons and training, LMSE approaches. Unsupervised learning. clustering: feature extraction.

Feedforward networks, delta rule and back propagation, Hopfield network and unsupervised learning Adaptive resonance architectures , related technique. Pattern associators and content addressable memories, hardware realization. Syntactic pattern recognition,: Formal languages and grammars pattern, grammar and higher dimensional grammars , Parsing , automata realization , stochastic grammars , Grammatical Inference , computational learning theory , Valiant's framework.

Text Books:

R.O. Duda,P.E. Hart and David Stork, Pattern Classification, Wiley , New York , 2000

Reference Books:

- 1.R.J. Schalkoff , Pattern Recognition : Statistical Structural and Neural approaches , Wiley , 1992
- 2.L.Miclet , structural Method in Pattern Recognition North Oxford Academic , London ,1986.

MCSE2.4.2 ADVANCED GENETIC ALGORITHMS

Introduction to Genetic algorithm (GA). steps in GA, Genome representation, fitness, selection methods. Operators in GA, GA parameters. Case study on GA applications Travelling salesman problem, sequence alignment in Bioinformatics, Genetic programming (GP): Steps in GP, individual representation, initial population, tree creation methods, fitness assessment, individual selection methods, GP operators, GP parameters. Parallel genetic programming, distributed genetic programming, parallel distributed GP. Case study on GP applications: symbolic regression, multiplexer, artificial ant, keepaway soccer, wall-following behavior.

Text Books:

David E. Goldberg, Genetic algorithm in search, optimization and machine learning .Pearson Education, 2006

Reference Books:

1. Wolfgangbanzhaf, et.al., Genetic programming : An introduction: On the automatic evolution of computer programs and its applications , MIT press.
2. John Koza, Genetic programming: On the programming of computers by means of natural selection, MIT press, 1992.
3. John Koza, Genetic programming II : Automatic discovery of reusable programs ,MIT press, 1994
4. John Koza, Genetic programming III : Darwinian invention and problem solving, Morgan kaugmann publisher, 1999

5. John Koza, Genetic programming IV : Routine human competitive machine intelligence , Kluwer academic publisher3, 2003

MCSE2.4.3 WEB TECHNOLOGY AND E-COMMERCE

HTML & XHTML: Basic layout of HTML, XHTML, DHTML and Formatting. Cascading style sheet, inline styles, embedded style, linking external style sheets, positioning elements, user style sheets, document object model. Structuring data in XML, namespaces, DTD and schemas, XML variables, DOM methods, simple API for XML, web services application of XML. Working of active Server Pages (ASP), ASP objects, file system, objects, ActiveX components, .NET overview, Java Technologies: Java programming, Java Applets , Java Server Pages, Java Script,J2EE. E-Commerce: B2B, B2C, C2C, C2B E-Security: Trust based security, password scheme, cryptography & firewall concept. E-Payment Standard: Digital token-based system, smart cards, micro-payments, e-cash, designing epayments system, digital signature. E-SCM & E-CRM.

Text Books:

. A.S. Godbole, Atul Kahate, Web Technology: TCP/IP to Internet Application Architecture, TMH,

Reference Books:

- 1: Deitel, Deitel and Neito, "INTERNET and WORLD WIDE WEB – How to program", Pearson education asia, 2002
- Eric Ladd, Jim O' Donnel, " Using HTML 4, XML and Java", Prentice Hall of India – QUE,
3. Jeffy Dwight, Michael Erwin and Robert Niles, "Using CGI", prentice Hall of India – QUE,
4. Scot Johnson, Keith Ballinger, Davis Chapman, "Using Active Server Pages", Prentice Hall of India,
5. Margaret Levine Young, "Internet and WWW", 2nd Edition, Tata McGraw Hill,
6. Herbert Schildt, The Complete Reference – Java 2 , 4th Edition, Tata McGraw Hill,
6. R. Kalakota, A.B. Whinston, Frontier of Electronic Commerce , Addition- Wesley
7. P.T.Joseph, E-Commerce: A Managerial Perspective , PHI

MCSE2.4.4 EMBEDDED SYSTEM

Introduction to embedded systems: classification, characteristics and requirements. Timing and Clocks in Embedded Systems.

Task modeling and management. Real-time operating system issues. Signals: frequency spectrum, and sampling, digitization (ADC, DAC), signal conditioning and processing.

Modeling and characterization of embedded computing systems. Communication strategies for embedded systems: encoding, and flow control.

Fault Tolerance. Formal Verification

Text Books:

.Raj Kamal, Embedded systems: architecture, programming and design, Tata McGraw- Hill publishing Co. Ltd., 2003, (2005 reprint).

Reference Books:

- 1.H. Kopetz, Real-time Systems, Kluwer, 1997.
- 2.R. Gupta, Co-synthesis of Hardware and Software for Embedded Systems, Kluwer 1995.
- 3.Jane W S Liu, Real time systems, Pearson Education Pte. Ltd., 2001.

MCSE2.4.5 FUNCTIONAL PROGRAMMING

ML (CAML dialect); X-calculus and combinators; abstraction and higher order functions; lazy and eager evaluation; types, polymorphism and type inference; Equations and pattern matching; SECD machine; denotational semantics of functional languages; implementing functional languages.

Text Books:

- 1.P. Hudak , S. Peyton Jones and P. Wadler , Report on the Programming Language.
- 2.R. Bird and P. Wadler . Introduction to Functional Programming.
- 3.J.R. Hindley and J.P. Seldin Introduction to Lambda Calculus and Combinators. 1988

ELECTIVE IV (MCSE 2.5)

MCSE2.5.1 IMAGE PROCESSING

Digital Image representation; manipulation of images. 2-D DFT, computing DFT in matlab, filtering in the frequency domain, obtaining frequency domain filters from spatial filters, generating filters directly in the frequency domain. Image restoration; a model of the image degradation/restoration process, noise models, restoration in the presence of noise only spatial filtering, modeling the degradation function, direct inverse filtering, weiner filtering, constrained least squares filtering. Wavelets; theory fast wavelet transform, working with wavelet decomposition structures, the inverse fast wavelet transform, wavelets in image processing. Coding redundancy, interpixel redundancy, psychovisual redundancy, JPEG compression. Image segmentation; point, line and edge detection, line detection using the Hough transform, thresholding, region based segmentation, segmentation using watershed transform. Representation and Description, boundary description, regional descriptors. Object recognition; computing distance measures in MATLAB, recognition based on decision theoretic methods, structural recognition.

Text Books:

Rafael C. Gonzalez, Richard E. wooda et al., Digital Image Processing Using MATLAB, Pearson Education Publisher, 2007.

Reference:

1. Anil K Jain, "Fundamentals of Digital Image Processing", Pearson Education/Prentice-Hall of India Pvt. Ltd., 1997.
2. B.Chanda, D Dutta Majumder, "Digital Image Processing and Analysis", Prentice-Hall, India, 2002.

MCSE2.5.2 MOBILE COMPUTING

Introduction Medium access control Telecommunication systems Satellite systems
Broadcast systems.

Standards Wireless LAN IEEE 802.11 HIPERLAN Bluetooth.

Adhoc Networks Characteristics Performance issues Routing in mobile hosts.

Network issues Mobile IP, DHCP, Mobile transport layer, Indirect TCP, Snooping
TCP, Mobile TCP, Transmission / time-out freezing, Selective retransmission,
Transaction oriented TCP.

Application Issues: Wireless application protocol Dynamic, DNS File systems
Synchronization protocol, Context-aware applications, Security Analysis of existing
wireless network.

Text Books:

J. Schiller, Mobile Communications, Addison Wesley 2000

Reference Books:

William C. Y. Lee, Mobile Communication Design Fundamentals, John Wiley 1993.

MCSE2.5.3 GRID AND CLUSTER COMPUTING

Meta computing, Scientific, Business and e –Governance Grids, Web Services and Grid Computing,
Grid –Architectures for Grid Computing : Clustering and Grid Computing, Issues in Data Grids, Key
Functional Requirements/ Standards in Grid Computing, Recent Technological Trends in Large
Data Grids.

Service Oriented Architecture, SOAP and WSDL, Creating Web Services, Server Side. OGSA and
WSRF. Issues in Database Integration with the Grid, The Requirements of a Grid enabled Database,
Storage Request Broker (SRB), The Architecture of OGSA - DAI for Offering Grid Database
Services. Approaches to Parallel Computing, Categories of Clusters. Levels and Layers of Single

System Image (SSI), Cluster Middleware Design Objectives, Resource Management and Scheduling, Cluster Programming Environment and Tools.

Setting Up and Administering a Cluster: Design Considerations for the Front End of a Cluster, Setting Up Nodes, Clusters of Clusters or Meta clusters, System Monitoring, Directory Services Inside the Clusters & DCE, Global Clocks Sync, Administering Heterogeneous Clusters.

Cluster Technology for High Availability, Mission Critical Applications, Types of Failures and Errors, Cluster Architectures and Configurations for High Availability, Faults and Error Detection, Failure Recovery, Failover/Recovery Clusters.

Text Books:

C.S.R.Prabhu – “Grid and Cluster Computing” -PHI(2008)

Reference Books:

Jankiram, “Grid Computing Models : A Research Monograph”, TMH (2005)

MCSE2.5.4 REAL TIME SYSTEMS

Introduction Real Time Systems Embedded Systems. Pervasive Computing Information Access Devices Smart Cards Embedded Controllers Hardware Fundamentals.

RTOS Real Time Operating Systems Memory Management Processes, Threads, Interrupts, Events User Interface.

Real Time UML Requirements Analysis Object Identification strategies Object Behaviour Real-Time Design Patterns.

Software Development Concurrency Exceptions Tools Debugging Techniques Optimization Case Studies.

Connectivity Wireless Connectivity Blue Tooth Other short Range Protocols Wireless Application Environment Service Discovery Middleware.

Text Books:

1. R.J.A. Buhr, D.L. Bailey, An Introduction to Real-Time Systems , Prentice-Hall International, 1999

2. B.P. Douglass, Real-Time UML 2nd Edition , Addison-Wesley, 2000.

Reference Books:

1. D.E. Simon, An Embedded software Primer , Addison-Wesley, 1999

2. J. Schiller, Mobile Communications , Addison-Wesley, 2000

3. V. Hansmann, L. Merk, M.S. Nicklous, T. Stober, Pervasive Computing Handbook Springer 2001

MCSE2.5.5 INFORMATION STORAGE AND RETRIEVAL

Document and query forms: Concept, data structures, document surrogates, vocabulary control, the fine structure of data, data compression, text documents, images and sound. Query structures:

matching criteria, Boolean queries, vector queries, extended Boolean queries, fuzzy queries, probabilistic queries, natural language queries, information retrieval and data base systems.

The matching process: relevance and similarity measures, Boolean based matching, vector based matching, missing terms and relationships, probabilistic matching, proximity matching, effects of waiting, effects of scaling, data fusion, the user centered view. Text analysis: indexing, matrix representation, term extraction and analysis, term association, lexical measures of term significance, other methods of document analysis, document similarity, stop lists, stemming, multilingual retrieval systems, thesauri.

Retrieval effectiveness measures: binary versus N-ary measures, precision and recall . Effectiveness improvement technologies: Information the user may find helpful, relevance feedback, genetic algorithms, genetic algorithms for relevance feedback, genetic algorithms in a realistic situation, the tree experiments.

Natural language processing, citation processing, hypertext links, information filtering and passage retrieval, image and sound processing. Document Access: Electronic access, processing scanned documents, processing electronically generated documents, distributed document systems, internet and web access.

Text Books:

Robert R. Korfhage, Information Storage And Retrieval, Student edition, Wiley India Edition.

Reference Books:

1. Managing Gigabytes, by I. Witten, A. Moffat, and T. Bell.
2. Modern Information Retrieval, by R. Baeza-Yates and B. Ribeiro-Neto.
3. Information Retrieval: Algorithms and Heuristics by D. Grossman and O. Frieder

MCSE 2.6: PROGRAMMING LAB – II

Students must undertake minimum of nine programming exercises such that the programming exercises cover the contents of each of subjects MCSE 2.1, MCSE 2.2 and MCSE 2.4.

SEMESTER III

MCSE 3.1: ADVANCED COMPILER DESIGN

Symbol Table Structure – Intermediate Representations – Run Time Issues – Support for Polymorphic and Symbolic Languages. Control Flow Analysis – Data Flow Analysis – Dependency analysis – Alias analysis. Review of Early Optimizations – Redundancy Elimination – Loop Optimizations – Procedure Optimization. Register Allocation – Local and Global Instruction Scheduling – Advanced Topics in Code Scheduling – Low Level Optimizations – Introduction to interprocedural analysis and scheduling. LEX and YACC programming: - Design and Implementation of Lexical, Syntax, Semantic Analyzer. Case Study with respect to open source compilers: Learning phases of Compiler from implementation point of view, Optimization of Compiler, Analysis of Compiler using Time and Space Complexity.

Text Books:

1. Steven Muchnick. Advanced Compiler Design Implementation, Morgan Kauffmann Publishers, 1997
2. Aho, A. V, Sethi, R. and Ullman, J. D. Compilers: Principles, Techniques and Tools, Addison Wesley, 1986

Reference Books:

1. Appel, A. W. Modern Compiler Implementation in Java, Cambridge University Press, 2000.
2. K.. C. Louden, Compiler Construction. Principles and Practice. Thomson, 2003.
3. Technical papers for Case Study topics
4. LEX and YACC tutorials

ELECTIVE V (MCSE 3.2) MCSE3.2.1 FUZZY LOGIC DESIGN

Crisp and fuzzy sets – classical logic and Fuzzy logic. Operations on fuzzy sets - fuzzy complement/ union/intersection – combinations of operations – general aggregation operations. Crisp and fuzzy relations – binary relations – binary relations on a single set– equivalence and similarity relations – Compatibility or tolerance relations– orderings, Membership functions – – defuzzification methods. Fuzzy measures – belief and plausibility measures – probability measures– possibility and necessity measures – relationship among classes of fuzzy measures.

Fuzzy Logic and Applications Classical logic/fuzzy logic – fuzzy rule based systems – fuzzy decision making – fuzzy logic in database and information systems – fuzzy pattern recognition – fuzzy control systems.

Text Books:

John Yen and Reza Lengari, Fuzzy Logic: Intelligence, Control and Information, Pearson Education, 1999.

Reference Books:

1. George J Klir and Tina A Folger, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, 1998.
2. H.J. Zimmerman, Fuzzy set theory and its Applications, 4th edition, Kluwer Academic Publishers, 2001.
3. Hung Nguyen and Elbert Walker, A first course in Fuzzy logic, 2nd Edition, Chapman and Hall/CRC, 1999.

MCSE3.2.2 CRYPTOGRAPHY AND NETWORK SECURITY

Review of number theory and algebra, computational complexity, probability and information theory, primality testing. Cryptography and cryptanalysis, symmetric key encryption, DES, Triple DES, AES, RC4, modes of operation. public key encryption, RSA cryptosystem, Diffie-Hellman, elliptic curve cryptography, Rabin, ElGamal, Goldwasser-Micali, Blum-Goldwasser cryptosystems. Message authentication, digital signature algorithms. Security handshake pitfalls, Strong password protocols. Review of wired/wireless network protocols, intrusion detection systems, malicious software. Kerberos, PKI, real-time communication security, IPsec: AH, ESP, IKE. SSL/TLS, e-mail security, PEM and S/MIME, PGP, web security, network management security, wireless security.

Text Books:

W. Stallings, Cryptography and Network Security Principles and practice, 3/e, Pearson Education Asia, 2003.

Reference Books

1. W. Mao, Modern Cryptography: Theory & Practice, Pearson Education, 2004.
2. C. Kaufman, R. Perlman and M. Speciner, Network Security: Private Communication in a public World, 2/e, Prentice Hall, 2002.
3. H. Delfs and H. Knebl, Introduction to Cryptography: Principles and Applications, Springer-Verlag, 2002

MCSE3.2.3 OBJECT ORIENTED MODELING AND DESIGN

Object Oriented Fundamentals, Basic structural Modeling, UML Model, Class Diagrams, Object Diagrams, Packages and Interfaces, Case Studies. Behavioral and architectural Modeling: Use Case Diagrams, Interaction Diagrams, State Chart Diagrams, Collaborations, Design Patterns, Component Diagrams, Deployment Diagrams. Object oriented Testing Methodologies: Implications of Inheritance on Testing, State Based Testing, Adequacy and Coverage, Scenario Based Testing, Testing Workflow, Case Studies , Object Oriented Metrics Abuses of inheritance, danger of

polymorphism, mix-in classes, rings of operations, class cohesion and support of states and behavior, components and objects, design of a component, lightweight and heavyweight components..

Text Books:

Page Jones M., Fundamentals of Object Oriented Design in UML, Pearson Education, 2002

Reference Books

1. Booch G., Rumbaugh J. & Jacobsons I., The Unified Modeling Language User Guide, Addison Wesley, 2002.
2. Bahrami A., Object Oriented System Development, McGraw Hill, 2003.
- 3 Man C., Applying UML & Patterns: An Introduction to Object – Oriented Analysis & Design, Addison Wesley, 2002.
4. Ooley R. & Stevens P., Using UML: Software Engineering with Objects & Components, Addison Wesley, 2000.

MCSE3.2.4 ROBOTICS

Automation and Robots; Robot Classification, Robot Specifications, Direct Kinematics: Frames, Translations and Rotations, Composite Homogenous Transformations; Screw Transformations; Link Co-ordinates; The Arm Equation; A Five-Axis Articulated Robot; A Four-Axis Scara Robot; A Six-Axis Articulated Robot; Solving the Arm Equation: The Inverse Kinematics Problem; Work Space Analysis and Trajectory Planning : Work Space Analysis; Work Envelope of a Five-Axis Articulated Robot; The Manipulator Jacobian; Induced Joint Torques and Forces; Problems. Manipulator Dynamics : Lagrange's Equation; Kinetic & Potential Energy; Generalised Force; Lagrange – Euler Dynamic Model; Dynamic Models of a Two-Axis Planer Articulated Robot and A Three-Axis SCARA Robot; Direct & Inverse Dynamics; Recursive Newton – Euler Formulation; Dynamic Model of a One-Axis Robot; The Control Problems; State Equations; Constant Solutions; Linear Feedback Systems; Single-Axis PID Control; PD-Gravity Control; Computed –Torque Control; Variable-structure Control; Impedance Control; Problems.

Text Books:

1. Fundamental of Robotics (Analysis & Control) by Robert J.Schilling, Published by PHI, Pvt. Ltd., New Delhi.
2. Introduction to Robotics (Mechanics & Control) by John J. Craig, Published by Addition Wesley (Intl. Student Edition).

Reference Books

1. Analytical Robotics & Mechatronics by Wolfram Stadler, Published by Mc-Graw Hill, Inc., New Delhi.
- 2 Industrial Robotics – Technology, Programming & Applications by Mikell P. Grover, Weiss, Nagel and Ordef , Published by Mc-Graw Hill International Edition.
3. Robots and Control – R.K.Mittal and I.J.Nagrath – Tata McGraw Hill 2003.

MCSE3.2.5 MULTI-CORE ARCHITECTURE

Motivation for Concurrency in Software, Parallel Computing Platforms, Multi-Core, Hyper-Threading technology, Multi-threading on Single-Core versus Multi-Core Platforms, Understanding Performance, Amdahl's Law, Growing Returns. Virtual Environment: VMs and Platforms. Runtime Virtualization, System Virtualization Threads design. Error Diffusion Analysis of Error: Diffusion Algorithm. Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control-Based Concepts. Comparing Superscalar and EPIC Architecture. Hardware-Based Threading, Threading form Intel Hyper-Threading Technology, Hyper-Threading Technology Architecture Multi-Core Processors Architectural Details, Comparison with other processor. Power Consumption, Power Metrics Reducing Power Consumption Beyond Multi-Core Processor Architecture.

Text Books:

Shameem akhtar and Jason Roberts, 2006 , "Multicore Programming" Intel press April 2006

Reference

Keckler, Stephen W; Olukotun, Kunle; Hofstee,H. Peter(Eds);2009, 'Multicore Processors and Systems'