Veer Surendra Sai University of Technology

M. Tech Syllabus

In

Information Technology

Specialization: Information & Communication Technology

Department of Information Technology

Department of Information Technology
M. Tech in Information Technology

Specialization: Information & Communication Technology

1st Semester				2nd Semester			
Theory				**Theory**			
Subject Code	**Subject**	**L-T-P**	**Credit**	**Subject Code**	**Subject**	**L-T-P**	**Credit**
MIT-101	Wireless Networks & Mobile Commuting	3-1-0	4	MIT-104	Advanced Internet Technology	3-1-0	4
MIT-102	Information Theory	3-1-0	4	MIT-105	AI & Machine Learning	3-1-0	4
MIT-103	Network Security	3-1-0	4	MIT-106	Computer Vision & Image Processing	3-1-0	4
Elective-I & II				**Elective-III & IV**			
MCS-101	Advanced Data Structure and Algorithms	3-1-0	4	MEC-116	Embedded Systems	3-1-0	4
MCS-102	Advanced Computer Architecture	3-1-0	4	MCS-111	Computational Intelligence	3-1-0	4
MCS-103	Software Engineering and OOAD	3-1-0	4	MCS-112	Bio-Informatics	3-1-0	4
MCS-104	Real Time Systems	3-1-0	4	MIT-109	Fault Tolerant Computing	3-1-0	4
MCS-106	Data Mining			MIT-110	Advanced Operating System		
MIT-107	Digital Signal Processing	3-1-0	4	MIT-111	Advanced Database System	3-1-0	4
MIT-108	Geographical Information System	3-1-0	4	MEC-103	VLSI Design	3-1-0	4
Practicals / Sessionals				**Practicals / Sessionals**			
MIT-211	Advanced Simulation Laboratory – I	0-0-6	4	MIT-212	Advanced Simulation Laboratory – II	0-0-6	4
MIT-221	Seminar – I	0-0-3	2	MIT-222	Seminar – II	0-0-3	2
MIT-231	Comprehensive Viva Voce – I		2	MIT-232	Comprehensive Viva Voce – II		2
Total			**28**	**Total**			**28**

3rd Semester				4th Semester			
Practicals / Sessionals				**Practicals / Sessionals**			
Subject Code	**Subject**	**L-T-P**	**Credit**	**Subject Code**	**Subject**	**L-T-P**	**Credit**
MIT-243	Dissertation Interim Evaluation		10	MIT-244	Dissertation Open Defense		5
MIT-233	Comprehensive Viva Voce		3	MIT-245	Dissertation Evaluation		20
MIT-223	Seminar on Dissertation		2				
Total			**15**	**Total**			**25**

Grand Total = 96

WIRELESS NETWORK AND MOBILE COMPUTING (3-1-0)Cr.-4

MIT-101

INTRODUCTION: Wired Network vs. Wireless Network, Overview of Wireless Applications, Wireless Transmission: Path loss, Multi-path propagation, Doppler shift, Fading, Time Division Multiplexing, Frequency Division Multiplexing, Code, Spread Spectrum Technique, Satellite Communication

CELLULAR SYSTEM: Cellular Network Organization, Cellular System Evolution, Cellular fundamentals: Capac ity, Topology, Operation of Cellular Systems, Handoff, Power control, Case study: Global System for Mobile communication (GSM) Network, General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA 2000), Cordless System, Wireless Local Loop, Mo bility Management - Location Management, HLR-VLR scheme, Hierarchical scheme, Predictive location management schemes

WIRELESS NETWORK: Protocols: Media Access Protocol, Mobile IP, Mobile Transport Layer Protocol, Wireless Access Protocol, Ad -Hoc Networks and Routing, Standards: IEEE 802.11, Wi -Fi, Wireless Broadband - Wi-MAX, Bluetooth, IEEE 802.15, Security in Wireless Network, Hyper LAN

MOBILE COMPUTING: Mobile Computing, Issues: Resource Management, Interference, Bandwidth, Cell Splitting, Frequency reuse, Mobile Data Transaction Models, File Systems, Mobility Management, Security

Text Books:

1. William Stallings, “Wireless Communications & Networks”, 2/E, Pearson Education India, Reprint 2007.
2. Jochen Schiller, “Mobile Communications”, 2/E, Pearson Education India, reprint 2007.

References:

1. Sandeep Singhal, “The Wireless A pplication Protocol” , Addison Wesley, India, reprint 2001
2. T S Rappaport, "Wireless Communications: Principles & Practice", 2/E, Pearson Education, 2002.
3. C E Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.

INFORMATION THEORY (3-1-0)Cr.-4

MIT-102

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.

Text Book:

1. Elements of Information Theory , T.M.Cover, J.A.Thomas, Wiley
2. R.J.McEliece, The Theory of Information and Coding, Addison-Wesley.

References:

1. S. Roman, *Coding and Information Theory*, Springer, 1992.
2. R. J. McEliece, *The Theory of Information and Coding*, Cambridge Uinv Press, 2004.
3. R. Bose, *Information Theory Coding and Cryptography*, Tata McGraw Hill, 2003.

NETWORK SECURITY (3-1-0)Cr.-4

MIT-103

Network architecture, attacks, covert channels, Security at the Application Layer (PGP and S/MIME), email, PGP, S/MIME, MIME, S/MIME. Security at the Transport Layer (SSL and TLS): SSL architecture, Protocols : Handshake, changecipherspec, alert, record, SSL Message format, Transport Layer Security. Security at the Network Layer(IPSec): Modes, Two security protocols, Security association, security policy, Internet key exchange, ISAKMP. Recent trends in network security.

Text Book:

1. B. A. Forouzan, *Cryptography & Network Security*, McGraw Hill, Special Indian Edition, 2007.
2. W. Stallings, *Cryptography and Network Security*, Pearson Education, 3rd Ed, 2006.

References:

1. N. Krawety, *Introduction to Network Security*, Thompson, Special India Ed, 2007.

(For Elective – I & II in First Semester)

ADVANCED DATA STRUCTURES AND ALGORITHMS (3-1-0)CR.-4

MCS101

Complexity Analysis & Elementary Data Structures: Asymptotic notations - Properties of big oh notation - asymptotic notation with several parameters - conditional asymptotic notation - amortized analysis - NP-completeness- NP-hard – recurrence equations – solving recurrence equations – arrays – linked lists – trees.

Heap Structures: Min-max heaps – Deaps – Leftist heaps – Binomial heaps – Fibonacei heaps Skew heaps – Lazy-binomial heaps.

Search Structures: Binary search trees – AVL trees – 2-3 trees – 2-3-4 trees – Red-black trees – B-trees – splay trees Tries.

Multimedia Structures: Segment trees – k-d trees - Point Quad trees - MX-Quad trees – R-trees – TV-trees.

Applications: Huffman coding - Garbage collection and compaction – Topological sort Mincut maxflow algorithm – Activity networks Set representation – Set union and find operations – Counting binary trees.

Text Book:

1. Thomas H.Corman, Charles E.Leiserson, Ronald I.Rivest, "Introduction to Algorithms", Second Edition, PHI 2003.

References:

1. E.Horowitz, S.Sahani and Dinesh Mehta, Fundamentals of Data Structures in C++, Galgotia, 1999.
2. Adam Drozdex, Data Structures and algorithms in C++, Second Edition, Thomason learning vikas publishing house, 2001.
3. G.Brassard and P.Bratley, Algorithmics: Theory and Practice, Printice Hall, 1988.
4. V.S.Subramanian, Principles of Multimedia Database Systems, Morgan Kaufman, 1998.

ADVANCED COMPUTER ARCHITECTURE (3-1-0)Cr.-4

MCS 102

Parallel Processing: Definition, Theory of Parallelism. Parallel Computer Models, Parallelism in Uni-processor computers, Implicit Parallelism vs. explicit parallelism, Levels of parallelism.Soft ware Parallelism, Hardware Parallelism.

Conditions of Parallelism: Data and Resource Dependencies, Control Dependence, Resource dependence, Berrnstein's condition, Hardware and software parallelism, Flow dependence, Anti dependence, output dependence, I/O dependence, unknown dependence.

Program flow Mechanism: Control flow versus data flow, Demand-driven mechanism, Comparison of flow mechanisms, Dataflow computer Architecture, Static dataflow and dynamic dataflow computer, Communication Latency, grain packing and scheduling in parallel programming environment, program partitioning, fine grain program, coarse grain program graph.

Parallel Interconnection Systems: Static and Dynamic Networks, Linear Array, Ring, Star, Tree, Mesh, Systolic Array, Chordal ring, Completely connected network, Cube connected cycles, Torus, K-ary-n cube, Barrel shifter, single stage interconnection network, Multistage Interconnection Networks, Control Structure, Node degree, diameter, Bisection width,

symmetric, functionality, Network Latency, Bandwidth, Scalability, Data routing functions:- Permutation, Perfect shuffle exchange, Hypercube Routing function.

Pipelining: Linear pipe line processor, Asynchronous and Synchronous models, speed up, Efficiency, Throughput, Non linear pipe line processor, Instruction pipeline, pipeline hazards, Arithmetic pipeline.

Multiprocessor and multicomputers: Hierarchical bus system, crossbar and multi port memory, cross point switch, Flynn's classification: SISD, SIMD, MISD, MIMD, message passing, Loosely coupled and tightly coupled system. Vector processor, memory hierarchy, CISC scalar processor, RISC scalar processor, C-access and S-access memory organization. Basic ideas on parallel algorithm, SIMD algorithm for matrix multiplication.

Fault-tolerance and reliability, Availability, System Performance attributes of parallel Computers.

Text Books:

1. Advanced Computer Architecture, by Kai Hwang Mc Graw Hill.
2. Introduction to Parallel Computing, 2nd Edition, Pearson Education by Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar.

Reference Books:

1. Computer Architecture – A quantitative approach By J.L Hennessy and D.A.Patterson (Morgan)
2. Computer Architecture and Parallel Processing, by K.Hwang and F.A. Briggs. Mc Graw Hill, International

SOFTWARE ENGINEERING AND OOAD(3-1-0)Cr.-4

MCS 103

Managing software projects: Overview to software Project, Software Product and Software Process, Project management concepts, Responsibility of Software Project Manager, Software Project Planning, Metrices for project size Estimation, Project Estimation Technique, Project scheduling technique (WBS, PERT, Gantt Chart, CPM) and tracking, Staffing, Overview to Risk Management, Risk Management Activities, Software Quality Assurance, Software Configuration management (SCM): Goals, Objectives, SCM Activities, SCM tools and Standards.

Requirement Engineering and Specification: Requirement Engineering Definition, Req. Engineering Technique, Software Requirement and its objectives, Req. Engineering Activities, Software Requirement Specification (SRS): Goals, quality Quality and characteristics of good SRS, benefits, Uses and Components of SRS, SRS Structure, Specification technique, Formal Specification, Algebraic specification and Model based specification.

Software Design Strategies and Methods: What is good software Design? , Good Vs. Bad Design, Cohesion and Coupling: Classification of Cohesion and Coupling, Software Design Approach: Function Oriented Design and Object Oriented Design, Overview to SA/SD Methodology: Structure Analysis, Tools for structure Analysis, DFDs. Designing and Developing DFD Models Shortcoming of DFD, Extending DFD technique to Real time System, Structured Design, Tools for structure Design, Flow chart Vs. Structure chart, Transformation of DFD in to Structure Chart, Detail Design.

Object Oriented Software Engineering: Conventional methods for software engineering: Design Concepts and principles. Architectural design, Component level Design, User Interface Design, software Coding and Testing Techniques, Software testing Strategies: Black box and White box testing, Integration and system testing, Object Oriented Concepts and principles, Object Oriented Analysis, Object Oriented Design, UML, UML Diagram: USE Case Model, CLASS Diagram, Inter action diagram, Activity Diagram, State Chart Diagram, Object Oriented Software Development Object Oriented testing, Technical metrics for Object-Oriented Systems, Implementation and Maintenance.

Software Reliability and Quality Management: Software reliability, Software Quality, Software Quality Management system, ISO Certification.

Computer Aided Software Engineering: Overview to CASE, CASE Tool Classification of CASE Tool, Characteristics of Case Tools, CASE for Future.

Component Based Software Engineering: Overview, Component based Software Development, Advantage, Limitations.

Software Re-Engineering: What is Software Re-Engineering? Benefits of Software Re-Engineering, Re-Engineering Activities, Software Reverse Engineering: Goals, Types of Reverse Engineering, Program Re-Structuring, Source Code Translation, Data Re-Engineering.

Text Books:

1. Ian Sommerville, “Software Engineering”, Pearson Education Asia.

Reference Books:

1. Roger S. Pressman, “Software Engineering A Practitioners Approach”. Mc-Graw Hill Publication.
2. Rajib Mall, “Fundamental of Software Engineering”, PHI

REAL-TIME SYSTEMS (3-1-0)Cr.-4

MCS 104

Introduction: What is Real Time? Applications of Real-Time Systems, A Basic Model of a Real-Time System, Characteristics of Real-time Systems, Safety and Reliability, Types of Real-Time Tasks, Timing Constraints, Modelling Timing Constraints.

Real-Time Task Scheduling: Some Important Concepts, Types of Real-Time Tasks and Their Characteristics, Task Scheduling, Clock-Driven Scheduling, Hybrid Schedulers, Event-Driven Scheduling, Earliest Deadline First (EDF) Scheduling, Real Monotonic Algorithm (RMA), Some Issues Associated with RMA, Issues in Using RMA in Practical Situations.

Handling Resource Sharing and Dependencies Among Real-Time Tasks: Resource Sharing Among Real-Time Tasks, Priority Inversion, Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP), Priority Ceiling Protocol (PCP), Different Types of Priority Inversions Under PCP, Important Features of PCP, Some Issues in Using a Resource Sharing Protocol, Handling Task Dependencies.

Scheduling Real-Time Tasks in Multiprocessor and Distributed Systems: Multiprocessor Task Allocation, Dynamic Allocation of Tasks, Fault-Tolerant Scheduling of Tasks, Clocks in Distributed Real-Time Systems, Centralized Clock Synchronization, Distributed Clock Synchronization.

Commercial Real-Time Operating Systems: Time Services, Features of a Real-Time Operating System, Unix as a Real-Time Operating System, Unix-Based Real-Time Operating Systems, Windows as a Real-Time Operating System, POSIX, A Survey of Contemporary Real-Time Operating Systems, Benchmarking Real-Time Systems.

Real-Time Databases: Example Applications of Real-Time Databases, Review of Basic Database Concepts, Real-Time Databases, Characteristics of Temporal Data, Concurrency Control in Real-Time Databases, Commercial Real-Time Databases.

Real-Time Communication: Examples of Applications Requiring Real-Time Communication, Basic Concepts, Real-Time Communication in a LAN, Soft Real-Time Communication in a LAN, Hard Real-Time Communication in a LAN, Bounded Access Protocols for LANs, Performance Comparison, Real-Time Communication Over Packet Switched Networks, Qos Framework, Routing, Resource Reservation, Rate Control, Qos Models.

Text Books:

1. Real-Time Systems, by Rajib Mall (Pearson Education)

References:

1. Liu, "Real-Time Systems", Pearson Education, 2001.
2. Alan Burns, Andy Wellings, "Real-Time Systems and Programming Languages 3/e", Addison Wesley.
3. Raymond A.Buhr and Donald L.Baily, "Introduction to Real-Time Systems", Prentice Hall.
4. Nissanke, "Real-Time System", Prentice Hall.

DATA MINING (3-1-0)Cr.-4

MCS 106

Data Mining overview: Data Warehouse and OLAP Technology Data Warehouse Architecture, Steps for the Design and Construction of Data Warehouses, A Three-Tier Data Warehouse Architecture, OLAP , OLAP Queries, Metadata Repository, Data Preprocessing – Data Integration and Transformation, Data Reduction, Data Mining Primitives, System Architectures – Data Mining Primitives: What Defines a Data Mining Task? Task-Relevant Data, The Kind of Knowledge to be Mined, KDD

Mining Association Rules in Large Databases, Association Rule Mining, Market Basket Analysis: Association Rule Mining, Basic Concepts, Association Rule Mining A Road Map, Mining Association Rules from Frequent Itemsets, Mining Multilevel Association Rules from Transaction Databases, Multilevel Association Rules, Approaches to Mining Multilevel Association Rules, Mining Distance-Based Association Rules, From Association Mining to Correlation Analysis.

Classification and Prediction – What is Classification? What Is Prediction? Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Bayes Theorem, Classification by Back propagation, A Multilayer Feed-Forward Neural Network, MLP, RBFN, Defining a Network Topology, Classification Based of Concepts from Association Rule Mining, Other Classification Methods, k-Nearest Neighbor Classifiers, Genetic Algorithms, Fuzzy Set Approaches, Prediction, Linear and Multiple Regression, Nonlinear Regression, Other Regression Models, Classifier Accuracy.

Cluster Analysis – What Is Cluster Analysis, Types of Data in Cluster Analysis, , A Categorization of Major Clustering Methods, Classical Partitioning Methods: k-Means and k-Medoids, Partitioning Methods in Large Databases: k-Medoids, Hierarchical Methods, Agglomerative and Divisive Hierarchical Clustering, Clustering Using Wavelet Transformation, Clustering High-Dimensional Space, Model-Based Clustering Methods, Statistical Approach, Neural Network Approach, LVQ, SOM,Mining Time-Series and Sequence Data, Mining Text Databases, Mining the World Wide Web. Applications and Trends in Data Mining – Data Mining Applications, Data Mining System Products.

Text Books:

1. Data Mining: – Concepts and Techniques by Jiawei Han and Micheline Kamber, -- Morgan Kaufmann Publisher (Elseviers)
2. Data Mining Concepts, Models, Methods and Algorithms By Mehmed Kantardzic Wiley Interscience, IEEE Press.

References:

1. Data Mining Techniques: - by A.K. Pujari,, Tenth Edition, Universities Press.

DIGITAL SIGNAL PROCESSING (3-1-0)CR.-4

MIT 107

Two Dimensional Systems & Mathematical Preliminaries: Linear Systems and Shift Invariance; the Fourier Transform; Optical and Modulation Transfer Functions; Matrix Theory Results; Block Matrices and Kronecker Products; Random Signals; Discrete Random Fields; the Spectral Density Function; Some results from information theory. Image Perception, Image Sampling and Quantization, Image Transforms, Image Enhancement, Image Filtering and Restoration, Image Analysis and Computer Vision Spatial Feature Extraction; Transform Features; Edge Detection; Boundary extraction; Boundary, Region, Moment Representation; Structure; Shape Features; Texture; Scene Matching and Detection; Image Segmentation; Classification Techniques; Image Understanding. Image Reconstruction from Projections, Image Data Compression. Recent advances in image processing.

Text Books:

1. J. G. Proakis and D. G. Manolkis, *Digital Signal Processing: Principles, Algorithms and Applications*, Prentice Hall of India, 3rd Ed, 1996, reprint 2005.

References:

1. V. Oppenheim & R. W. Schafer, *Digital Signal Processing*, Prentice Hall of India, 8th Ed, 2002.
2. S. W. Smith, *Digital Signal Processing: A Practical Guide for Engineers and Scientists*, Newness – Elsevier Science, 1st Ed, 2002.

GEOGRAPHICAL INFORMATION SYSTEM (3-1-0)CR.-4

MIT 108

Introduction of a GIS: The Success with which a GIS can be used, Geographic Data, GIS vs. CAD vs. DBMS vs. computer mapping, Land Information Systems, Why use a GIS? Who uses a GIS? Applications of GIS

Remote Sensing: History of Remote Sensing, Remote Sensing Resolutions, Remote Sensing Sensors, Steps Used to Analyse Remotely Sensed Data, Applications of Remote Sensing to GIS

Data Input and Output: Data Entered into a GIS, Methods of Data Input, GIS Output.

Data Quality: components of Data quality, Sources of Error

Data Management: approaches to database management, Classic data models

Analysis of Spatial Data: Cartographic Modeling, Divisions of GIS Functions, Maintenance and Analysis of Spatial Data, Maintenance and Analysis of Non-Spatial Data, Integrated analysis of Spatial and Attribute Data, Output Formatting, Phases in GIS Implementation.

Text Books:

1. An Introduction to Geographical Information Systems by Ian Heywood, Sarah Cornelius, Steve Carver.
2. The Global Positioning System and GIS : An Introduction by Michael Kennedy

2ND SEMESTER M.TECH.

ADVANCED INTERNET TECHNOLOGY (3-1-0)Cr.-4

MIT-104

INTRODUCTION: Internet Architecture and World Wide Web, Internet Protocols, Web Servers, Web Application and Design Issues, Proxy Server, Plug-in modules, Web Server Configuration, Web document and Web page designing using Markup Languages (SGML, HTML, XML, VRML etc.), Dynamic Pages, Scripting, Common Gateway Interface, Sessions, Cookies, Web – Database server interface, Search Engine, Web crawlers, Web Services

WEB CONTENT INTEGRATIONS AND APPLICATION: Centralized systems, Client - server systems, Parallel and Distributed Systems, Databases access parallelism, Inter-query and Intra-query parallelism, Inter-operation & Intra-operation parallelism, Transactions and Internet application, Transaction Processing, Management of Log Audits, Distributed objects, Object request brokers, Component technology, Payment protocols and standards: Smart card, E -cash, E-wallet technologies, Electronic money and Electronic payment systems.

SECURITY ISSUES: Web server, client security issues, Web Application security, Authentication on the web, Web sessions, Various Issues: Signatures, Digital certificates, Privacy, Traceability, Encryption, Firewalls, and Wat ermark.

INTEGRATION WITH ENTERPRISE APPLICATIONS: Overview-enterprise systems architecture, issues: reliability, availability, replication, performance scalability, backup and disaster recovery Electronic publishing, Electronic commerce, Dist ance education, Collaborative working underlying principles and practices, Multimedia Content, Business -to-Business System - Business-to-Consumer System, Web access using Mobile and Wireless System

Text Books:

1. Karl Barksdale,E. Shane Turner, “HTML, JavaScript, and Advanced Internet Technologies”,1 /E,CourseTechnology,2005.
2. Steve Krar, “Advanced Manufacturing Technology”, I/E, Industrial Press, 2003

References:

1. Online Resources: www.w3.org, www.ietf.org, www.omg.org, www.xml.org, www.microsoft.com/com
2. Steven M. Cohen,” Keeping Current: Advanced Internet Strategies to Meet Librarian and Patron Needs”, American library association, 2003.
3. Simson Garfinkel, Gene Spafford, Alan Schwartz , “Practical Unix & Internet Security”, 3 /E, O'Reilly Media,2003

AI & MACHINE LEARNING (3-1-0)CR.-4

MIT-105

APPROACHES TO ARTIFICIAL INTELLIGENCE. SEARCH AND PRODUCTION SYSTEMS: State space, and/or and game tree search. Design, implementation and limitations, ca se studies.

KNOWLEDGE REPRESENTATION: Semantic networks, predicate calculus, structural / causal networks

CURRENT ISSUES & APPLICATIONS: Inference control, theorem proving, deduction, truth maintenance, planning, Case study of one or more examples from natural language processing, question answering, vision, expert systems, etc. Philosophical issues.

MACHINE LEARNING: Bayes Decision Theory, Statistical Decision Making, Parame ter Estimation, Supervised and Un –supervised Learning, Non-parametric Techniques, Learning based on Logic, Classification, and Neural Networks, Genetic Algorithm and Fuzzy Systems

Text Books:

1. E. Rich," Artificial Intelligence", MGH, 1983.
2. Christopher M. Bishop :, "Pattern Recogni tion And Machine Learning (Information Science and Statistics)" , 1/E, Springer, January 2008

References:

1. E. Charniak and D. McDermott, "Introduction to Artificial Intelligence", Addison -Wesley, 1985.
2. J. Sowa," Conceptual Structures", Addison -Wesley, 1984.
3. Nils J. Nilsson," Artificial Intelligence", 1/E, Morgan kaumann, 1998.
4. Herbert Schorr and Alien Ra ppaport, "Innovative Application of Artificial Intelligence", AAAI Press, 1989.1. Richard O. Duda, Peter E. Hart, David G. Stork," Pattern Classification ", 2/E, Wiley -Interscience, 2000.
5. T. Hastie , R. Tibshirani, J. H. Friedman:, "The Elements of Statistical Learning ",1/E ,Springer, Reprint 3/E, 2003
6. Christopher M. Bishop ;"Pattern Recognition and Machine Learning", Springer, 2006
7. Shigeo Abe,"Advances in Pattern Recognition", Springer, 2005

COMPUTER VISION & IMAGE PROCESSING (3-1-0)CR.-4

MIT-106

INTRODUCTION: Human and Computer Vision, Image Formation, Radiometry, Image Representation and Modeling, Reflectance Map, Overview of Image and Vis ion Applications

Image Processing: Low level and High level Image Processing, Image Enhancement, Histogram Equalization, Spatial Filters, Frequency Representation and Filters, Edge detection, labeling,

Image Segmentation, Morphological Operat ion, Object Boundary Detection and Representation, Texture

COMPUTER VISION: Camera Calibration, Patterns, Features Extraction, Statistical Methods for Classification, Clustering, Neural Network Techniques, Training and Classification, Object R ecognition, Scene Matching and Analysis, Robotic Vision, Knowledge Representation, Bidirectional Reflection Distribution Function, Optical Flow, Shape from Shading, Structure from Motion, Three Dimensional Structure Representation

Text Books:

1. Rafael C. Gonzales and Rich ard E. Woods, "Digital Image Processing", Pearson Education, Reprint 2004
2. Anil K. Jain, "Fundamental of Digital Image Processing", PHI, EEE, 3rd reprint 1997

References:

1. David A. Forsyth and Jean Ponce,"Computer Vision: A Modern Approach", Prentice -Hall, 2004
2. J. R. Parker, " Algorithms for Image Processing and Computer Vision", Wiley ,1996
3. Robert M. Haralick and Linda G. Shapiro, "Computer and Robot Vision **",** Addison Wesley, 1992

(For Elective – III & IV in Second Semester)

EMBEDDED SYSTEMS (3-1-0)CR.-4

MEC-116

Introduction: An Embedded system, Processor in the system, Other hardware units, Software embedded into a system, Exemplary embedded systems, Embedded System-on-chip (SOC) and in VLSI circuit.

Devices and Device Drivers: I/O Devices, Timer and counting devices, Serial communication using the 'I^2C', 'CAN' and advanced I/O buses between the networked multiple devices, Host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advanced buses, Device drivers, Parallel port device drivers in a system, serial port device drivers in a system, Interrupt servicing (Handling) mechanism.

Software and Programming Concept ; Processor selection for an embedded system, Memory selection for an embedded system, Embedded programming in C++, Embedded programming in Java, Unified Modeling Language (UML), Multiple processes and application, Problem of sharing data by multiple tasks and routines, Inter process communication.

Real Time Operating System: Operating system services, I/O subsystems, Network operating systems, Real-Time and embedded system operating systems, Need of a well tested and debugged Real-Time Operating System (RTOS), Introduction to mC/OS-II.

Case Studies of Programming with RTOS: Case study of an embedded system for a smart card.

Hardware and Software Co-design: Embedded system project management, Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded system, Use of software tools for development of an embedded system, Issues in embedded system design.

Text Books:

1. Embedded Systems-Architecture, Programming and Design – Raj Kamal, TMH

References:

1. Hardware Software Co-design of Embedded Systems – Ralf Niemann, Kluwer Academic.
2. Design Principles of Distributed Embedded Applications – Hermann Kopetz, kluwer Academic.
3. Embedded Real-Time Systems Programming – Sriram V. Iyer and Pankaj Gupta,TMH.

COMPUTATIONAL INTELLIGENCE (3-1-0)CR.-4

MCS-111

Introduction to Soft Computing: Soft computing constituents and conventional Artificial Intelligence, Neuro-Fuzzy and Soft Computing characteristics.

Fuzzy Sets, Fuzzy Rules and Fuzzy Reasoning: Introduction, Basic definitions and terminology, Set-theoretic operations, MF Formulation and parameterization, More on fuzzy union, intersection, and complement, Extension principle and fuzzy relations, Fuzzy If-Then rules, Fuzzy reasoning.

Fuzzy Inference System: Mamdani fuzzy models, Sugeno Fuzzy Models, Tsukamoto fuzzy models, other considerations.

Least Square Method for system Identification: System Identification, Basic of matrix manipulations and calculus, Least-square estimator, Geometric interpretation of LSE, Recursive least-square estimator, Recursive LSE for time varying systems, Statistical properties and maximum likelihood estimator, LSE for nonlinear models.

Derivative-based optimization: Descent methods, the method of steepest descent, Newton's methods, Step size determination, conjugate gradient methods, Analysis of quadratic case, nonlinear least-squares problems, Incorporation of stochastic mechanism.

Derivative-free optimization: Genetic algorithm simulated annealing, random search, Downhill simplex search.

Adaptive Networks: Architecture, Back propagation for feed forward networks, Extended back propagation for recurrent networks, Hybrid learning rule: combing steepest descent and LSE.

Supervised learning neural networks: Perceptrons, Adaline, Back propagation multi layer perceptrons, Radial Basis Function networks.

Learning from reinforcement: Failure is the surest path to success, temporal difference learning, the art of dynamic programming, Adaptive heuristic critic, Q-learning, A cost path problem, World modeling, other network configurations, Reinforcement learning by evolutionary computations.

Unsupervised learning and other neural networks: Competitive learning networks, Kohonen self-organizing networks, learning vector quantization, Hebbian learning, principal component networks, and The Hopfield network.

Adaptive Neuro-fuzzy inference systems: ANFIS architecture, Hybrid learning algorithms, Learning methods that cross-fertilize ANFIS and RBNF, ANFIS as universal approximator, Simulation examples, Extensions and advance topics.

Coactive Neuro-fuzzy modeling: towards generalized ANFIS: Framework, Neuro functions for adaptive networks, Neuro-Fuzzy spectrum, Analysis of adaptive learning capability.

Text Books:

1. J.S.R. Jng, C.T. Sun and E. Mizutani, "Neuro-fuzzy and soft Computing", PHI.
2. S.Rajasekaran, G.A. Vijaylakshmi Pai, "Neural Networks, Fuzzy Logic, and Genetic Algorithms", PHI.

BIO-INFORMATICS (3-1-0)CR.-4

MCS – 112

Introduction to Genomic data and Data Organization: Sequence Data Banks – introduction to sequence data banks – protein sequence data bank. NBFR-PIR. SWISSPORT. Signal peptide data bank, Nucleic acid sequence data bank – GenBank, EMBL nucleotide sequence data bank. AIDS virus sequence data bank. PRNA data bank, structural data banks- protein Data Bank

(PDB). The Cambridge Structural Database (CSD) : Genome data bank – Metabolic pathway data; Microbial and Cellular Data Bank.

Introduction to MSDN (Microbial Strain Data Network) : Numerical Coding Systems of Microbes, Hibridoma Data Bank Structure, Virus Information System Cell line information system; other important Data banks in the area of biotechnology/life sciences/biodiversity.

Sequence analysis: Analysis Tools for Sequence Data Bank: Pair wise alignment – NEEDLEMAN and Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data; Sequence patterns motifs and profiles.

Secondary Structure Predictions; prediction algorithms; Chao-Fasman algorithm. Hidden-Markov model, Neural Networking.

Tertiary Structure predictions; prediction algorithms; Chao-Fasman algorithm. Hidden-Markov model, Neural Networking.

Application in Biotechnology : Protein classifications, Fold libraries, Protein structure prediction : Fold recognition's (threading), protein structure predictions : Comparative modeling (Homology), Advanced topics : Protein folding, Protein-ligand interactions, Molecular Modeling & Dynamics, Drug Designing.

Text Books:

1. Lesk, Introduction to Bio Informatics, OUP

References:

1. Introduction to Bio-informatics, Atwood, Pearson Education
2. Developing Bio-informatics Computer Skills, Cynthia Gibas andd Per Jambeck. 2001 SPD
3. Murty CSV, Bioinformatics, Himalaya

FAULT TOLERANT COMPUTING (3-1-0)CR.-4

MIT – 109

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 tradeoffs. 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 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.

Text Books:

1. D. K. Pradhan, editor, *Fault Tolerant Computer System Design*, Prentice Hall, 1996.
2. I. Koren. *Fault Tolerant System*s, Morgan Kauffman 2007.

References:

1. L. L. Pullum, *Software Fault Tolerance Techniques and Implementation*, Artech House Computer Security Series, 2001.
2. M. L. Shooman, *Reliability of Computer Systems and Networks Fault Tolerance Analysis and Design*, Wiley, 2002

ADVANCED OPERATING SYSTEM (3-1-0)CR.-4

MIT – 110

System Architecture Types, Distributed Operating Systems, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Global State, Chandy-Lamport's Global State Recording Algorithm, Cuts of a Distributed Computation, Termination Detection, Mutual Exclusion Algorithms, Performance Measures, Non-Token-Based Algorithms, Token-Based Algorithms, Comparative Performance Analysis, Deadlock Handling Strategies, Centralized Deadlock-Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms, Agreement Protocols, Distributed File Systems, Distributed Shared Memory, Distributed Scheduling, Multiprocessor Operating Systems.

Text Book:

1. M. Singhal and N. G. Sivaratri, "Advanced concepts in Operating Systems", Tata McGraw Hill Publications, 2001.

References:

1. Coulouris, "Distributed Systems: Concepts and Design", Pearson Education.

ADVANCED DATABASE SYSTEM (3-1-0)CR.-4

MIT – 111

INTRODUCTION: Objectives and Review of the basic concepts - The Object-oriented Data Model – Object oriented Databases - ODMG - Nested Relational Model.

DATABASE SYSTEM ARCHITECTURES: Centralized systems - Client-server systems - Parallel systems, Distributed systems - Network Types. Parallel Databases parallelism - Inter-query and Intra-query parallelism - Inter-operation & Intra-operation parallelism.

DESIGN OF PARALLEL SYSTEMS. DISTRIBUTED DATABASES: Distributed DBMS Implementations. Features of Distributed Client/Server DBMS. Advanced RDBMS Features.

RDBMS Reliability and Availability Robustness - Consistency Fault Tolerance. RDBMS Administration. Distributed Data Storage - Distributed Query processing - Distributed Transaction model -Commit protocols - Concurrency control - Deadlock handling. Multi - database Systems. Database connectivity standards - Concept of the Middle-ware Products.

WEB ENABLED APPLICATIONS: Review of 3-tier architecture - Typical Middle-ware products and their usage. Architectural support for 3 –tier applications: technologies like RPC, CORBA, COM. Web Application server - WAS architecture Concept of Data Cartridges - JAVA/HTML components. WAS security.

DATA & WEB WAREHOUSING: Data Warehouse Definition and Characteristics Data Warehouse Architecture. Client/Server Computing Model & Data Warehousing. Query and Reporting Tools ,Data Warehouse Design Considerations, Multi –relational OLAP, MOLAP, ROLAP - Managed Query Environment (MQE), OLAP Tools and the Internet, Security and Integrity User Interfaces

USER INTERFACES: Forms, graphics, semi-graphics, spread sheet, natural language. Query optimization: techniques like query modification.

OBJECT ORIENTED DATABASES: Notion of abstract data type, object oriented systems, object oriented db design. Expert data bases : use of rules of deduction in data bases, recursive rules.

FUZZY DATA BASES: Fuzzy set & fuzzy logic, use of fuzzy techniques to define inexact and incomplete data bases

Text Books:

1. A Silberschatz, Henry Korth, S. Sudarshan, “Database System Concepts”, 3/E, MGH, 1997.
2. Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining, and OLAP”, MGH, 1998

References:

1. R Sigmore, M O Stegman, J Creamer, “The ODBC solution”, MGH, 1995.
2. Mattison, Rob Mattison, “Web Data Warehousing and Knowledge Management”, MGH, 1999.
3. W. Kim, “Introduction to Object Oriented Databases”, MIT Press, 1992.

VLSI DESIGN (3-1-0)CR.-4

MEC – 103

Introduction to VLSI Design Methodologies, Full Custom Design, Semi Custom Design & Programmable Design, VLSI Design Flow, Design Entry, Synthesis, Floor Planning, Place & Route, Timing analysis, Front-end and Backend design

Front End Design: Introduction to high level Design, Hardware description language. VHDL: Introduction, Behavioral Modeling, sequential processing, Data types, Sub program & Packages, Attributes, Configurations**.** Synthesis: HDL (RTL), Constraints, Technology Library m Synthesis: transaction, Boolean Optimization, Flattening, Factoring and Mapping gates. High level Design flow. Synthesis tools: Synopsis**.**

Backend Design: Introduction to low level Design. MOS Structure: Band Diagram, NMOS, PMOS, CMOS digital logic gates Inverters. Digital Design: Static Logic, Switch logic & dynamic logic design styles. Analog Design: Differential Amplifiers, Current Mirrors, Design of Operational Amplifiers. Introduction to SPICE (T-Spice) for circuit simulation VLSI Technology.

Fabrication Process (NMOS & CMOS) : Wafer Preparation, Oxidation, Photo & Ion Lithography, Etching, Diffusion, Ion implementation, Metallization.

Layout Design: Stick diagram and layout of digital circuit, introduction to Layout generation tools. (VLSI Software: Tanner L-Edit), CiF & GDS-II formats.

Design of Telecom Chips: Introduction to VLSI Design of modulators, Demodulators, Trans-receiver ICs, Coder & Decoders, Companies involved in communication chip design.

Text Books:

1. Application Specific Integrated Circuits by Smith (for UNIT:I)
2. VHDL by Douglas Perry, TMH Publication (for UNIT-II)
3. VLSI Design & Techniques, Puknell & Eshraghian, PHI,(for UNIT-III and UNIT-V)
4. VLSI Technology S. M. Sze, McGraw Hill(for INIT-IV)

References:

1. W. H. Wolf, *Modern VLSI Design System on chip design*, Prentice Hall of India, 3rd ed. 2004.
2. C. Mead & L. Conway, *Introduction to VLSI system*, Addison Wesley, 2004.
3. Resource from internet: www.ti.com