

# MCTA – 301 (A) Data Mining and Warehousing

**Introduction:** Data Mining: Definitions, KDD v/s Data Mining, DBMS v/s Data Mining , DM techniques, Mining problems, Issues and Challenges in DM, DM Application areas.

**Association Rules & Clustering Techniques:** Introduction, Various association algorithms like A Priori, Partition, Pincer search etc., Generalized association rules. Clustering paradigms; Partitioning algorithms like K-Medoid, CLARA, CLARANS; Hierarchical clustering, DBSCAN, BIRCH, CURE; categorical clustering algorithms, STIRR, ROCK, CACTUS.

**Other DM techniques & Web Mining:** Application of Neural Network, AI, Fuzzy logic and Genetic algorithm, Decision tree in DM. Web Mining, Web content mining, Web structure Mining, Web Usage Mining.

**Temporal and spatial DM:** Temporal association rules, Sequence Mining, GSP, SPADE, SPIRIT, and WUM algorithms, Episode Discovery, Event prediction, Time series analysis. Spatial Mining, Spatial Mining tasks, Spatial clustering, Spatial Trends. Data Mining of Image and Video : A case study. Image and Video representation techniques, feature extraction, motion analysis, content based image and video retrieval, clustering and association paradigm, knowledge discovery.

The vicious cycle of Data mining, data mining methodology, measuring the effectiveness of data mining data mining techniques. Market baskets analysis, memory based reasoning, automatic cluster detection, link analysis, artificial neural networks, generic algorithms, data mining and corporate data warehouse, OLA.

## Reference Books :

1. Data Mining Techniques ; Arun K.Pujari ; University Press.
2. Data Mining; Adriaans & Zantinge; Pearson education.
3. Mastering Data Mining; Berry Linoff; Wiley.
4. Data Mining; Dunham; Pearson education.
5. Text Mining Applications, Konchandy, Cengage

# MCTA – 301(B) Web Engineering

**Introduction:** layering, DNS - encapsulation, de-multiplexing, client /server model, port numbers, standardization process, the Internet. Link layer: introduction, Ethernet and IEEE 802 encapsulation, trailer encapsulation, SLIP, PPP- Loop back interface, MTU.

**Internet protocol:** introduction, IP header, IP routing, subnet addressing, subnet mask- special case of IP addresses, a subnet example. Address Resolution Protocol: Introduction, an example, ARP cache, ARP packet format, ARP examples, Proxy ARP, ARP command.

**RARP:** Introduction, RARP packet format, RARP examples, RARP server design. ICMP: Introduction, ICMP message types, ICMP address mask request and reply- ICMP timestamp request and reply- 4.4 BSD processing of ICMP Messages.

**Ping Program:** Introduction, ping program, IP record route option, IP Time stamp option. Trace route program: Introduction, trace route program operation, LAN output, and WAN output- IP source routing option. IP routing: Introduction, routing principles, ICMP host, and ICMP redirect errors. Dynamic Routing protocols: introduction, dynamic routing, RIP-OSPF, BGP, CIDR.

**UDP:** introduction, UDP header, UDP checksum, IP Fragmentation, UDP Server design. DNS Introduction- basics, message format, simple example, pointer quires, resource records, caching, UDP. TFTP: introduction, protocol, security. BOOTP: introduction, packet format, server design, through router.

**TCP:** Introduction, services, headers, connection establishment and termination, timeout of connection establishment- maximum segment size- half, close, state transition diagram, reset segments, simultaneous open and close- options, server design.

SNMP Introduction, protocol, structure of management information, object identifiers, management information base, instance identification. Telnet: rlogin protocols, examples, telnet protocol and examples. FTP, protocol, examples, SMTP protocols, examples, NFS, TCP/IP Applications.

## Reference Books :

1. W. Richard Stevens, TCP/IP Illustrated Volume-I "The Protocols ", Addison W 2.
- Jaiswal .S, TCP/IP Principles, Architecture, Protocols And Implementation, First Edition, Galgotia Publications Pvt Ltd.

# **MCTA – 301(C) Real Time & Fault Tolerant System**

Fault detection and diagnosis. System Reliability and methods of improving it. Theory of redundant system design. Fault tolerant circuit design. Fault tolerant architectures.

Components of a real time system. Real time operating system., tasks and task scheduling, task synchronization and data transfer factors in selecting a real time operating system. The design specifications, the development environment, ASM Diagram and Data flow analysis. Response time specification.

## **Reference Books :**

1. " Real Time System"-C.M Krishna and Kang G.Shin, TMH.
2. "Software Design for Real Time Systems"- J.E.Cooling, Chapman & Hall Pub.

# **MCTA – 301(D) Bio Informatics**

## **Unit 1**

Introduction to Bioinformatics, algorithm design and computational complexity aspects in bioinformatics, paradigms for algorithm design like greedy, divide and conquer, dynamic programming, exhaustive search and randomization help in obtaining useful bioinformatics algorithms,

## **Unit 2**

Genome rearrangement, block alignment, global sequence alignment, finding regulatory motifs in DNA sequences, finding minimum energy conformation in drug molecules respectively exemplifying the uses of these paradigms.

## **Unit 3**

Application of computational learning in bioinformatics, the learning of probabilistic finite automata (Hidden Markov Models)

## **Unit 4**

Several important problems in computational biology, like protein folding which turn out to be NP-hard, study some of these problems and corresponding approximation algorithms that address the issue of intractability.

## **Reference Books:**

1. Neil Jones and P Pevzner; An introduction to Bioinformatics Algorithms, MIT Press
2. Peter Clote and R Backofen, Computational Molecular Biology, J Wiley
3. R. Durbin, Eddy etc; Biological sequence analysis, probabilistic models of protein and nucleic acids; Cambridge Univ Press.

# MCTA – 301(E) Simulation & Modeling

**Introduction to modeling and simulation:** Modeling and simulation methodology, system modeling, concept of simulation, continuous and discrete time simulation. Basic concept of probability and random variables, continuous and discrete random variables and their distributions, Compartmental models: linear, nonlinear and stochastic models.

**Introduction to Queuing Theory:** Characteristics of queuing system, Poisson's formula, birth-death system, equilibrium of queuing system, analysis of M/M/1 queues. Application of queuing theory in computer system like operating systems, computer networks etc.

**System Dynamics modeling:** Identification of problem situation, preparation of causal loop diagrams and flow diagrams, equation writing, level and rate relationship. Simulation of system dynamics models.

**Verification and validation:** Design of simulation experiments, validation of experimental models, testing and analysis. Simulation languages comparison and selection, study of Simulation sw -SIMULA, DYNAMO, STELLA, POWERSIM.

## Reference Books:

1. Gordon G., System simulation, Prentice Hall.
2. Payer T., Introduction to system simulation, McGraw Hill.
3. Seila, Applied Simulation Modeling, Cengage
4. Spriet, Computer Aided Modeling and Simulation, W.I.A.
5. Sushil, System Dynamics, Wiley Eastern Ltd.
6. Shannon R.E., System simulation, Prentice Hall
7. Law and Kelton; Simulation Modeling

# MCTA – 301(F) Ad-hoc Network

1. **Ad Hoc Networking** : An introduction, Model of operation, symmetric Links, Layer-2 Ad Hoc solutions, Proactive versus reactive protocols, multicast, commercial Applications of Ad Hoc networking, conferencing, Home Networking, Emergency services, personal Area Networks and Bluetooth, Embedded Computing Applications, Sensor Dust, Automotive/PC Interaction. Factors Affecting Ad Hoc Networks, Scalability, Wireless Data Rates, DARPA packet Radio network, Survivable Radio Networks.
2. **Ad Hoc Wireless Media Access Protocols:** Issues in Designing a MAC protocol for Ad Hoc Wireless networks. Design Goals of a MAC Protocol for Ad Hoc Wireless Networks. Classifications of MAC Protocols. Contention-Based Protocols, Contention-Based Protocols with reservation Mechanisms. Contention –Based MAC Protocols with Scheduling Mechanisms. MAC protocols that use Directional Antennas. Other MAC Protocols.
3. **Overview of Ad Hoc Routing Protocols:** Table-Driven Approaches, Destination Sequenced Distance Vector (DSDV) , Wireless Routing Protocol (WRP), Cluster Switch Gateway Routing (CSGR) , Source-Initiated On – Demand Approaches . Ad Hoc On-Demand Distance Vector Routing (AODV) , Dynamic Source Routing (DSR) , Temporally Ordered Routing Algorithm (TORA), Signal Stability Routing (SSR) , Location-Aided Routing (LAR) , Power – Aware Routing (PAR), Zone Routing Protocol (ZRP), Source Tree Adaptive Routing (STAR) , Relative Distance Microdiversity Routing (RDMAR) , Multicast Routing in Mobile Ad Hoc Networks, Existing Ad Hoc Multicast Routing Protocols, ABAM : Associativity-Based Ad Hoc Multicast.
4. **Transport Layer for Ad Hoc Wireless Network** : Introduction , Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocols for Ad Hoc Wireless Networks.
5. **Quality of service in Ad-hoc wireless networks:** Issues and challenges in providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, MAC Layer Solutions, Network Layer Solutions, Qos Frameworks for Ad Hoc Wireless Networks.
6. **Energy Conservation** : Power Life Issues: Power Management, Advances in Device Power Management, Advances in Protocol Power Management, Power Conservation by mobile Applications, Periodic Beaconsing On Battery Life, Standalone Beaconsing, HF Beaconsing with Neighboring Nodes, Comparison of HF Beaconsing with and without Neighbors, LF Beaconsing with Neighboring Nodes, Comparison of LF Beaconsing with and without Neighbors, Deductions, Conclusions, Smart Batteries and Battery Characteristics, Effects of Beaconsing on Battery Life.
7. **Sensor Network:** Sensor Network Architecture, Network Protocols, Data Storage and Manipulation, Localization and Management, Data Dissemination, Data Gathering, MAC protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards.
8. **Security issues in Ad Hoc Network:** Security in Ad Hoc Wireless Network, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, and Secure Routing in Ad Hoc Wireless Networks.

## Books Suggested

1. Ad Hoc Mobile Wireless Networks : Protocols and Systems, C. K. Toh, Springer.
2. Ad Hoc Network, C E Perkins, Pearson Education.
3. Ad Hoc Wireless Networks : Architectures and protocols, C, Siva Ram Murthy and B.S. Manoj, Pearson Education.

# **MCTA – 302(A) Software Testing & Quality Assurance**

Introduction to software testing, concepts, issues and techniques, test activities, management and automation. Coverage and usage testing based on checklist, input domain portioning and boundary testing, object oriented testing: testing OOA and OOD models, object oriented testing strategies, test case design for OO software, testing methods applicable at the class level, interclass test case design. Web application testing, debugging, security & reliability.

Programming style and program quality: simple style rules, comment statements, program quality, quantifying program quality, Software quality and quality Assurance: Principle of Software Quality Assurance (SQA), Applying SQA to software project, proven factors for SQA success, SQA during software requirements, SQA during software design phase, SQA during software code and test, Advance quality engineering topics.

Human factors in software engineering: Human factors history, HCL requirements and design process, HCL testing.

## **Reference Books:**

1. Ali Behforooz and Frederick J. Hudson, Software Engineering Fundamentals, Oxford University Press
2. JeffTain, Software Quality Engineering: Testing, Quality Assurance and Quantifiable improvement, Willy Pub.
3. Aditya Mathur, Foundation of Software Testing 1/e, Pearson Education
4. Paul C. Jorgensen, Software Testing, A Craftsman's Approach, Second Edition, CRC Press

# **MCTA – 302(B) Semantic Networks**

## **Unit I**

Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation – Layers – Architecture.

## **Unit II**

Web Documents in XML – RDF – Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics – Traditional Ontology Languages – LOOM – OKBC – OCML – Flogic Ontology Markup Languages – SHOE – OIL – DAML + OIL – OWL.

## **Unit III**

Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Evaluation.

## **Unit IV**

Overview – Need for management – Development process – Target ontology – Ontology mapping – Skills management system – Ontological class – constraints – issues. Evolution – Development of Tools and Tool Suites – Ontology Merge Tools – Ontology based Annotation Tools.

## **Unit V**

Web Services – Semantic Web Services – Case Study for specific domain – Security issues – Current trends.

## **References:**

1. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez, “Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web” Springer, 2004.
2. Grigoris Antoniou, Frank van Harmelen, “A Semantic Web Primer (Cooperative Information Systems)”, The MIT Press, 2004



# MCTA – 302(C) Embedded Systems

## Unit 1

Description and attributes of an embedded systems, CPU, memory, peripherals, timers, communication interfaces

## Unit 2

Software tool chains used for development and testing of programs, project manager editor, assembler, compiler, linker, locator, loader debugger, monitor and profiler, use of integrated development environment, GNU, command line tools, build process in embedded systems

## Unit 3

Software architecture for implementing various tasks, round robin with and without interrupts, function queue scheduling architecture, real-time operating systems.

## Unit 4

Hardware and software development methodology and use of hardware debugging aids like in circuit emulators and logic analyzers.

## Unit 5

Architecture of simple RTOS, definition of tasks, task controller, task information, scheduling priority, shared data problems and mutual exclusion critical section implementation.

## Unit 6

Intertask communication, semaphores, message queues, buffers pipes, reentrance issues, timer functions, interrupts and I/O, designing a real time application using a RTOS like Vworks,  $\mu$ COS II or embedded linux.

## Unit 7

Power optimization strategies for processes, ACPI, design case studies, Networked embedded system, distributed embedded architecture, HW and SW architecture, IIC bus, CAN bus, Myrinet network based design, communication analysis, system performance analysis, HW platform design, allocation and scheduling, internet embedded systems. System design techniques.

## Reference Books:

1. Simon DE; an embedded software primer; Pearson
2. Ayala K; 8051 programming and interfacing; Peram
3. Vahid F and Givargis T; Embedded system design...; John Wiley
4. Heath Steve; Embedded system designs; Oxford newness

## Internet sites

[www.embedded.com](http://www.embedded.com)

[www.washington.edu](http://www.washington.edu)

# **MCTA – 302(D) Mobile Computing**

## **UNIT 1**

Introduction to cellular mobile systems: Basic cellular system, performance, criteria, Uniqueness of mobile Radio environment, operation of cellular systems, marketing Image of Hexagonal shaped cells, Planning of cellular system, Analog cellular systems, digital cellular systems, cell splitting.

## **UNIT 2**

Cell coverage for signal & Traffic: Introduction, obtaining the mobile point to point model, Propagation over water or flat open areas, Foliage loss, Propagation in near in distance, long distance Propagation obtain path loss from a point to point Prediction model, call-site antenna Heights & Signal coverage calls, mobile to mobile Propagation.

## **UNIT 3**

Co channel Interference reduction: Co channel interference , exploring co channel interference area, in a system, Real time co channel interference measurement at mobile radio Transceivers, Decision of an omni directional antenna system, Design of a directional antenna system,. Lowering the antenna height, reduction of co-channel interference by mean of a notech in the tilted antenna Pattern, Power control.

## **UNIT 4**

Frequency management & channel Assignment: Frequency management, Frequency-spectrum utilization, set up channels definition of channel assignment, fixed channel assignment, Non fixed channel assignment algorithms How to operate north additional spectrum, Traffic & channel assignment, Perception of call blocking from the subscribers.

## **UNIT 5**

Handoffs & Dropped calls: Value of Implementing Handoffs, initiation of a hand off, Delaying a handoff, Forced Handoffs, Queuing of Handoffs, power difference handoff , Mobile assisted handoff & soft Handoff, call site Handoff only, intersystem Handoff, introduction to dropped call rate, Formula of Dropped call rate, Finding the values of  $g$  &  $u$ .

## **UNIT 6**

Special topics: Wireless and Mobile Computation – SS7, GSM, CDMA, Mobile IP, Wireless Mobile ATM, Multicast Routing Protocols, Location Management, Mobile Agents, Mobility Management.

## **Reference Books:**

1. J. Schiller, Mobile Communication, Pearson Press.
2. Wireless Network, Kaveh Pahalwan
3. Adhoc Networking by Charles E. Perkins, Addison Wisely
4. Mobile cellular Telecommunications by William C.Y. Lee TMH

# **MCTA – 302(E) Parallel Computing**

Parallel processing, Parallel computer structure, designing of parallel algorithms, analyzing algorithms, general principles of parallel computing, Parallel sorting algorithms Batcher's bitonic sort, Bitonic sort using the perfect shuffle, parallel bubble sort, add-even transport sort, Tree sort, quicksort, sorting on the CRCW, CRFW, EREW models, searching a sorted sequence, CREW, CRCW & EREW searching, searching on a random sequence EREW, ERCW, CREW & CRCW searching on SIMD computers, searching on a Tree, mesh, A Network for merging, merging on the CRFW, ERFW models, Computing Fourier Transforms, computing the DFT in parallel, a parallel FFT algorithm.

## **Reference Books**

1. Design & Analysis of Parallel Algorithm by Salim & Akl, PHI.
2. Design Efficient Algorithm for Parallel Computers by Michel J. Quinn, TMH