

# **PONDICHERRY UNIVERSITY**

## **Master of Technology**

**(Network & Internet Engineering)**

**( CBCS )**

(Effective from the academic year 2009 – 2010)

### Eligibility for Admission

B.Tech. / B.E. degree in computer science and Engineering/ Information Technology/ Electronics and Communication Engineering/ Electrical and Electronics Engineering/ Electronics and Instrumentation Engineering

OR

M.Sc in Computer Science/ Information Technology/ Software Engineering with a minimum of 55% marks.

OR

MCA with Bachelor's degree in Computer science/ Computer Applications/ Mathematics/ Statistics/ Physics/ Electronics/ Applied Science with a minimum of 55% marks in each degree.

### Duration of the Course

The course duration shall normally be of two years duration spread over four semesters. The maximum duration to complete the course shall be 4 years.

### Medium

The medium of instruction shall be English.

### Passing Minimum

Passing Eligibility & Classification for the award of the Degree are as per the Choice Based Credit System norms.

## Curriculum

(Effective from the academic year 2007-2008)

**Note:** All Course codes are to be preceded with “NIE”

**H – Hardcore Subject**

**S – Softcore Subject**

### Semester I

Code No	Course Title	H/S	L	P	C
611	Mathematics for Network Engineering	H	3		3
612	Computer Network Protocols	H	4		4
613	Network Components & Design	H	3		3
614	Internet and Web Technologies	H	3		3
615	Database Technologies	H	3		3
616	Usability Engineering	H	3		3
617	Software Lab-I (Network Protocols and Web Technologies Lab)			6	2
				<b>Total</b>	<b>21</b>

### Semester II

Code No	Course Title	H/S	L	P	C
621	High Speed Networks	H	3		3
622	Network Security	H	4		4
623	Semantic Web and Knowledge Management	H	3		3
624	Distributed Computing & Systems	H	3		3
	Elective I	S	3		3
	Elective II	S	3		3
625	Software Lab-II (Network Security and Web Services Lab)			6	2
				<b>Total</b>	<b>21</b>

### Semester III

Code No	Course Title	H/S	L	P	C
711	Wireless Communication Networks	H	3		3
712	Network Management	H	3	2	4
714	Project Work – Phase-I	H			8
	Elective III	S	3		3
				<b>Total</b>	<b>18</b>

### Semester IV

Code No	Course Title	H/S	L	P	C
721	Project Work	H			6
722	Project Report & Viva Voce	H			6
				<b>Total</b>	<b>12</b>

### List of Electives

<b>Code No</b>	<b>Course Title</b>	<b>H/S</b>	<b>L</b>	<b>P</b>	<b>C</b>
651	Storage Area Networks	S	3		3
652	Optical Networks	S	3		3
653	Cryptographic Techniques	S	3		3
654	E-Commerce Technologies	S	3		3
655	Search Engines & Optimizations	S	3		3
656	Network Infrastructure and Cyber Security	S	3		3
657	Advanced Network Design and Performance Tuning	S	3		3
658	Pervasive and Ubiquitous Computing	S	3		3
659	Information Storage Architecture	S	3		3
660	Sensor Networks	S	3		3
661	Embedded Systems	S	3		3
662	Cloud Computing	S	3		3
663	Real Time Systems	S	3		3
664	Bio-Metric Based Security Systems	S	3		3

## NIE 611 - MATHEMATICS FOR NETWORK ENGINEERING

### UNIT I

**Graph Theory Introduction:** Introduction Of Graphs, Paths, Cycles, And Trails, Vertex Degrees And Counting - Directed Graphs - Trees and Distance: Basic Properties. Spanning Trees and Enumeration, Optimization and Trees.

### UNIT- II

**Matching Connectivity and Flow:** Matching and Covers Algorithms and Applications. Matching in General Graphs. -Connectivity and Paths: Cuts and Connectivity, k-connected graphs - Network Flow Problems.

### UNIT III

**Planar Graphs, Edges and Cycles:** Planar Graphs - Embeddings and Euler's Formula - Characterization of Planar graphs - Parameters of Planarity, Line Graphs and Edge-Colouring, Hamiltonian Cycles, Planarity, Colouring and Cycles, Applications in Networks.

### UNIT IV

**Introduction to Probability Theory:** Probability concepts, Random variables, moments, Moment Generating function, Binomial, Poisson, Geometric, Negative binomial, Exponential, Gamma, Weibull distributions, Functions of random variable, Chebychev inequality, Application in Networks.

### UNIT V

**Queueing Theory:** Markovian queueing models, Little's formula, Multi-server queues, M/G/1 Queues, Pollaczek-Khintchine formula, Applications in Networks.

### REFERENCE BOOKS:

1. R J Wilson "Introduction to Graph Theory" , 4<sup>th</sup> Edition, Pearson Education 2003.
2. Reinhard Diestel "Graph Theory" ,, 2<sup>nd</sup> Edition, Springer- Verlag 2000.
3. Jay Yellen, Jonathan L.Gross "Graph Theory and Its Applications ",CRC Press LLC 1998.
4. Trivedi K.S., " Probability and Statistics with reliability, Queuing and Computer Science Applications ", Prentice-Hall of India, New Delhi, 1984.
5. Allen, A.O., "Probability Statistics and Queueing Theory ", Academic Press, 1981
6. Gross D, and Harris C.M, "Fundamentals of Queueing Theory ", John Wiley & Sons, 1985.

## **NIE 612 - COMPUTER NETWORK PROTOCOLS**

### **UNIT I**

Networks and Services, Approaches to Network Design, The OSI Reference Model; Overview of TCP/IP Architecture, Application Protocols and TCP/IP Utilities, Internet Architecture – Interconnection through IP Routers, Internet Protocol (IP), User datagram protocol (UDP).

### **UNIT- II**

Routing Cores - peers – Algorithms – Autonomous Systems – Exterior Gateway Protocol Multicast Address. Internet Group Management Protocol (IGMP) and Implementation. TCP/IP over ATM networks: ATM cell Transport , Adaptation Layer, IP Address Building in an ATM network – Logical IP subnet Concept – ATM-ARP packet format. Domain name system , Remote Login (Telnet, Rlogin) – File Transfer and Access (FTP, TFTP, NFS), Electronic mail (SMTP, MIME) – Internet Management (SNMP, SNMPV2) – Internet Security and Firewall Design – Post Office Protocol (POP) – Network News Transfer Protocol (NNTP).

### **UNIT III**

TCP/IP over view- The Transport Layer: TCP and UDP. Elementary TCP Sockets. TCP Client-Server Example. I/O Multiplexing: The select and poll Functions. Socket Options. Elementary UDP Sockets. Elementary Name and Address Conversions.

### **UNIT IV**

The Client Server Model and Software Design, Concurrent Processing in Client-Server Software, Iterative, Connectionless Servers (UDP), Iterative, Connection-Oriented Servers (TCP), Concurrent, Connection-Oriented Servers (TCP). Single-Process, Concurrent Servers (TCP). Multiprotocol Servers (TCP, UDP), Multiservice Servers (TCP, UDP). Uniform, Efficient Management of server. Concurrency in clients.

### **UNIT V**

TCP/IP Architecture, The Internet Protocol, Limitations of IPv4 and Introduction to IPv6, User Datagram Protocol, Transmission Control Protocol, DHCP, Introduction to Internet Routing Protocols

### **REFERENCE BOOKS:**

1. A. Leon-Garcia, Indra Widjaja, "Communication Networks", Tata McGraw Hill, 2000
2. William Stallings, " Data and Computer Communications", Pearson Education, 7<sup>th</sup> Edition
3. Andrew S. Tanenbaum, "Computer Networks", Prentice Hall India, 4<sup>th</sup> Edition, 2003
4. W.Richard Stevens: TCP/IP Illustrated vol 1: The Protocols, Pearson Edun. Asia, 2000.
5. Douglas Comer: Internetworking with TCP/IP vol.1: Principles, Protocols and Architecture, Prentice Hall, 4th edition, 2000.

## **NIE 613 - NETWORK COMPONENTS AND DESIGN**

### **UNIT I**

Network Components and Topologies : Basic Networking Components: Cables, Network adapter cards, Hubs, Switching Hubs. Network Interface, Link Interconnect and Switch. Network Topologies, Network Hardware Components, MAC Addresses, Access Methods, Ethernet and IEEE 802.3, Token Ring and IEEE 802.5, FDDI

### **UNIT- II**

Network installation and upgrades, Connectors, Components, Structured Wiring Systems, Wiring Techniques , Crimping Cables, Cabling Diagram, Wiring for a UTP Patch Cable, Wiring for a Cross-over Cable , Network Adapter Cards , Network Card Drivers , Configuring network services.

### **UNIT III**

Network Design : Major challenges in network design, centralized network design, distributed network design, Technical consideration of networking design and planning, Similarities and comparisons between LAN and WAN design, Performance analysis.

### **UNIT IV**

LAN and WAN network design : Management overview of LAN design and planning, Information source for baseline LAN models, LAN planning and design tools, Management overview of WAN network design, Technical overview of WAN network design, Major features and functions of automated design tools.

### **UNIT V**

Troubleshooting : Troubleshooting equipment, Terminators, Loopback test, Crossover cable , Volt-Ohm meters , Tone generators and probe , Cable Testers and Certifiers ,Time-Domain Reflectometer (TDR) , Product Indicators , Test Frame and Packet Generators, Network Monitors, Protocol Analyzer ,SNMP ,Troubleshooting Networks , Troubleshooting Cabling, Troubleshooting Infrastructure, Troubleshooting Name Resolution , Establishing a Session , Troubleshooting services, Service Packs and Driver Updates , Performance Monitor , Network Monitor.

### **REFERENCE BOOKS:**

1. Teresa C.Mann-Rubinson, Kornel Terplan, Network Design Management and Technical Perspective.
2. Network analysis architecture and design, James .D.McCabe, Published 2003
3. Networking for Beginners, Bruce Hallberg , Forth edition, 2004
4. Data and computer communications : Networking and Internetworking, Gurdeep S. Hura, Mukesh Singhal

## NIE 614 - INTERNET AND WEB TECHNOLOGIES

### UNIT I

**The internet Architecture:** Introduction – Evolution – Components – advantages - Web platform architecture – web application architecture – Classification of internet standards and technologies.

### UNIT- II

**The client:** Introduction – Browser dependent issues – Client Caching - DOM basics – Events manipulation – Object basics - Form and Data manipulation – Advanced DOM techniques – Error handling – XML and client side scripting.

### UNIT III

**The Server:** Introduction – components - Request and responses – Rendering dynamic contents – Manipulation of database from server side scripting- caching in server side - performance measures – Authentication and security – access controls in web servers.

### UNIT IV

**Web documents distribution and caching :** caching the web data - Interactions with enterprise server , application server etc. Web services : architecture, design and implementation issues , advantages and applications of web services.

### UNIT V

**Web2.0 :** Introduction, Technology overview - Ajax – Overview – Rethinking the web application – Core technology – Security in AJAX – case study on AJAX frameworks and libraries.

### REFERENCE BOOKS:

1. Guide to Web Application and Platform Architectures (Springer Professional Computing), 2004.
2. Stefan Jablonski, Iliia Petrov, Christian Meiler, Udo Mayer, 2003
3. Professional JavaScript for Web developers – Nicholas C Zakas Web Server Programming Neil Gray, 2003
4. Ajax in Action By Dave crane, Eric Pascarello and Darren James, 2005



## **NIE 615 - DATABASE TECHNOLOGIES**

### **UNIT I**

Introduction to database systems- views- data models – Database languages – E-R model – Relational Algebra - Relational model – querying – storage structures

### **UNIT- II**

Relational DB Design : Integrity constraints- Referential Integrity – assertions – triggers – Functional Dependency - Normalization - Programming Relational Databases- Interfacing to Relational databases; Extending the relational model; extending SQL with programming facilities (using PL/SQL); active rules (using Oracle Triggers).

### **UNIT III**

Object oriented Databases: Object oriented DBs -Object modelling in database systems- Object identity – OODBMS architecture and storage issues - Querying persistent objects- Transactions and concurrency control – clustering – indexing – case study

### **UNIT IV**

Web Databases : Web interfaces – overview of XML – structure of XML data – Document schema – Querying XML data – Storage of XML data – XML applications – Semistructured data models, compared with relational and object models- Implementation issues – Indexes for text data.

### **UNIT V**

Multimedia Databases: Nature of multimedia data: multimedia data storage and management; content-based querying and retrieval; meta-data generation, ontologies, challenges; retrieval from textual databases.

### **REFERENCE BOOKS:**

1. Korth, silberchatz, Sudarshan, Database Concepts, McGraw Hill , 4<sup>th</sup> edition
2. D. Jordan, C. Jones, Java Data Objects, O'Reilly, 2003.  
H. Garcia-Molina, J.D. Ullman and J. Widom, Database Systems: The Complete Book, Prentice Hall, 2002.
3. M. Piattini and O. Diaz, Advanced Database Technology and Design, Artech House, 2000.
4. L. Dunckley, Multimedia Databases: An Object Relational Approach, Addison-Wesley, 2003.

## **NIE 616 - USABILITY ENGINEERING**

### **UNIT I**

Introduction to Information Architecture: Introduction – Role of Information Architecture – Collaboration and communication. Organizing Information – Concepts – Challenges. Introduction to psychology of the user: Identifying the user groups. Design criteria : usability - content - ease of navigation - clear purpose & aesthetics. Scenario Based usability Engineering.

### **UNIT- II**

Conceptual Design: Brainstorming – Metaphor exploration – High level architecture blueprints – page mockups – web based prototypes. Production and Operations: Detailed Architecture blueprints – architecture style guides – learning from users. Stages of actions in Human computer interaction.

### **UNIT III**

Introduction to Web Navigation: Need – Design. Understanding the navigation system: Web browsing behavior – Information shape – Experiencing information. Mechanisms of Navigation : Step Navigation – Paging – Breadcrumb Trail – Tree Navigation – Site Maps – Directories – Tag Clouds – AZ indexes – Navigation Bars and Tabs – Vertical Menu – Dynamic Menus – Visualizing Navigation

### **UNIT IV**

Labeling systems : Introduction – Types of labeling systems – Fine tuning. Rich web applications : Concepts – Design Issues. Internationalization & Localization : Need – Concepts – Techniques – Issues.

### **UNIT V**

Usability evaluation and standards – Emerging paradigms of user interaction- Designing for Users with special needs: Need – Various accessibility techniques– Case studies

### **REFERENCE BOOKS:**

1. Louis Rosenfeld, Peter Morville : Information Architecture for the World Wide Web Designing Large-scale Web Sites . O'Reilly publications, 2006.
2. James Kalbach : Designing Web Navigation Optimizing the User Experience. O'Reilly publications, 2007.
3. Usability Engineering: Scenario-Based Development of Human Computer Interaction (Interactive Technologies) By Mary Beth Rosson, John M. Carroll, 2002.

## **NIE 621 - HIGH SPEED NETWORKS**

### **UNIT I**

#### **HIGH SPEED NETWORKS**

Introduction to Computer Networks - Review of OSI/ISO model - TCP/IP, Peer to peer Networks Frame Relay Networks - Asynchronous Transfer Mode - High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fiber Channel - Wireless LAN's, ISDN - FDDI.

### **UNIT- II**

#### **ATM**

Introduction ATM – ATM cell – Layered organization – Connection admission control – ATM cell switching – routing and addressing - IP over ATM - Segmentation and reassembly – SVC establishment - Circuit emulation – Performance management – Multicast routing in ATM networks – ATM over SONET

### **UNIT III**

#### **CONGESTION AND TRAFFIC MANAGEMENT**

Congestion control and traffic policing in ATM - QoS in IP networks - Integrated Service Architecture (ISA): Approach – Components – Services – Differentiated services – Protocols for QoS support – RSVP –RTP - Introduction to MPLS - Virtual Private networks – architectures – topologies – security.

### **UNIT IV**

#### **FRAME RELAY AND SONET**

Introduction to Frame Relay – operation and layers – Introduction to SONET – Optical components – SONET and SDH frames – Virtual tributaries - Synchronization and timing – Maintenance. Traffic Management Frame work. Introduction to VOIP

### **UNIT V**

#### **OPTICAL NETWORKS**

Introduction to Optical networks – Wavelength division multiplexing (WDM) – Introduction to broadcast-and-select networks - Switch architectures - channel accessing – Wavelength routed networks – Switch architectures - Routing and wavelength assignment – virtual topology design– IP over SONET over ATM over WDM – IP over ATM over WDM – IP over WDM.

#### **REFERENCE BOOKS:**

1. William Stallings, “HIGH SPEED NETWORKS AND INTERNET”, Pearson Education, Fourth Edition, 2005.
2. Behrouz A. Forouzan, Data Communications and Networking, 4<sup>th</sup> edition, Tata McGraw-Hill, 2005.
3. Warland & Pravin Varaiya, “HIGH PERFORMANCE COMMUNICATION NETWORKS”, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
4. Irvan Pepelnjk, Jim Guichard and Jeff Aparcar, “MPLS and VPN architecture”, Cisco Press, Volume 1 and 2, 2003.
5. Rajiv Ramaswami and Kumar N. Sivarajan, Optical Networks: A Practical Perspective, 1<sup>st</sup> Edition, Morgan Kaufmann, USA, 2001.
6. C. Siva Ram Murthy and Mohan Gurusamy, WDM Optical Networks: Concepts, Design, and Algorithms, Prentice Hall, USA, 2002.
7. Stamatios V. Kartalopoulos, Understanding SONET/SDH and ATM: Communications Networks for Next Millennium, Prentice-Hall of India, 2001.

## **NIE 622 - NETWORK SECURITY**

### **UNIT I**

#### **INTRODUCTION**

Introduction to Security in Networks - Elements of Security - Precepts of Security - Threat - Sniffing - External Threat - Types of External Threats - Denial of Service Attack - Kinds of security breaches - Virus -Worms -Trojans - Threats & Countermeasures - Trends in Security – Plan of attack - Points of vulnerability -Security Objectives and Services.

### **UNIT- II**

#### **CRYPTOGRAPHY**

Basic encryption and decryption – Encryption techniques – Characteristics of good encryption systems – Secret key cryptography – International Data Encryption Algorithm – Advanced Encryption Standard – Elliptic Curve Cryptography - Hash and MAC algorithms - Public Key encryptions – Introduction to number theory - RSA algorithm – Diffie-Hellman Key Exchange algorithm.

### **UNIT III**

#### **DIGITAL SIGNATURE AND AUTHENTICATION PROTOCOLS**

Digital Signatures - Digital Signature standard - Digital Signature and Authentication Protocols - Authentication Protocols - – Elliptic Curve cryptography - Trusted intermediaries – Security handshake pitfalls

### **UNIT IV**

Virtual Private Network (VPN): Evolution, Types, Architecture, Tunneling, Design Issues, Implementation, Security Issues – Firewall: Elements, Design Principles, Architecture, Packet Filtering, Bastion Host – Trusted System - Intrusion Detection system (IDS): Requirements, Classification, Types, Honeypots.

### **UNIT V**

#### **SECURITY AUDITING AND E-MAIL SECURITY**

Security Monitoring and Auditing - Designing an Auditing System, Implementation Considerations, Auditing to Detect Violations of a security Policy, Auditing Mechanisms, Audit Browsing - Electronic mail security – PEM and S/MIME security protocol – Pretty Good Privacy

### **REFERENCE BOOKS:**

1. William Stallings, Cryptography and Network Security: Principles and Standards, Prentice Hall India, 3rd Edition, 2003
2. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security: Private Communication in a public world, Prentice Hall India, 2nd Edition, 2002
3. Charles P. Pleegeer, Security in Computing, Person Education Asia.
4. William Stallings, Network Security Essentials: Applications and standards, Person Education Asia, 2000

## **NIE 623 - SEMANTIC WEB AND KNOWLEDGE MANAGEMENT**

### **UNIT I**

Introduction: Semantic web and Knowledge Management -roles of ontologies- Architecture for semantic web-based Knowledge Management- Tools for semantic web-based Knowledge Management

### **UNIT- II**

Ontology Languages for the Semantic Web: Introduction- OIL and DAML+OIL – Semantic web pyramid of languages- design rationale for OIL- OIL language constructs- Different syntactic forms- language layering- semantics- From OIL to DAML+OIL

### **UNIT III**

Ontology based Knowledge Management: Introduction- Feasibility Study- Kick off phase- Refinement phase- Evaluation phase- Maintenance and Evolution phase- Related Work  
Ontology Management- Storing, Aligning and Maintaining ontologies: The Requirement for Ontology Management- Aligning Ontologies- Supporting ontology change- organizing ontologies

### **UNIT IV**

Resource Description Framework: what is RDF- distinction between RDF model and syntax- RDF features- RDF and XML- non-contextual modeling – data modeling using RDF schema- Need for an RDFS query language  
Ontologies for semantic web: introduction- reading the web- information extraction- knowledge generation from natural language documents.

### **UNIT V**

Ontology based knowledge management- case studies - Semantic web tools

### **REFERENCE BOOKS:**

1. J. Davies, “Towards the Semantic Web: Ontology-driven Knowledge Management”, John Wiley & Sons Ltd., 2003
2. Tim Berners-Lee, “Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential”, The MIT Press; New Ed edition -March 1, 2005
3. Shelley Powers, “Practical RDF” O'Reilly Media, Inc.; 1st Edition -July 2003
4. John Davies, “Semantic Web Technologies: Trends and Research in Ontology-based Systems” Wiley- July 11, 2006
5. Thomas B. Passin, “Explorer's Guide to the Semantic Web” Manning Publications- March 1, 2004.
6. Lee W. Lacy, “Owl: Representing Information Using the Web Ontology Language” Trafford Publishing -January 1, 2005.
7. Grigoris Antoniou, Frank van Harmelen, “A Semantic Web Primer-Cooperative Information Systems”, The MIT Press-April 1, 2004

## NIE 624 - DISTRIBUTED COMPUTING AND SYSTEMS

### UNIT I

**INTRODUCTION:** Characterization of Distributed Systems - Examples - Resource Sharing and the Web - Challenges - System Models - Architectural and Fundamental Models - Networking and Internetworking - Types of Networks - Network Principles - Internet Protocols - Case Studies.

### UNIT- II

**PROCESSES AND DISTRIBUTED OBJECTS:** Inter Process Communication - The API for the Internet Protocols - External Data Representation and Marshalling - Client-Server Communication - Group Communication - Case Study - Distributed Objects and Remote Invocation - Communication Between Distributed Objects - Remote Procedure Call - Events and Notifications - Java RMI - Case Study.

### UNIT III

**OPERATING SYSTEM ISSUES:** The OS Layer - Protection - Processes and Threads - Communication and Invocation – OS Architecture - Distributed File Systems - File Service Architecture - Sun Network File System - The Andrew File System - Name Services -Domain Name System - Directory and Discovery Services - Global Name Service - Synchronizing - Physical Clocks - Logical Time And Logical Clocks - Global States - Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.

### UNIT IV

**DISTRIBUTED TRANSACTION PROCESSING:** Transactions - Nested Transactions - Locks - Optimistic Concurrency Control - Timestamp Ordering - Comparison - Flat and Nested Distributed Transactions - Atomic Commit Protocols - Concurrency Control in Distributed Transactions - Distributed Deadlocks - Transaction Recovery - Overview of Replication And Distributed Multimedia Systems

### UNIT V

**GRID COMPUTING:** Standards for Distributed and Grid Computing: Web Services Resource Framework (WSRF) - Common Object Request Broker Architecture (CORBA) - Distributed Resource Management Application API (DRMAA) - A Simple API for Grid Applications (SAGA) - Grid Security Infrastructure (GSI) - Open Grid Services Architecture (OGSA) - Open Grid Services Infrastructure (OGSI)

### REFERENCE BOOKS:

1. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, 3<sup>rd</sup> Edition, 2002.
2. Sape Mullender, Distributed Systems, Addison Wesley, 2<sup>nd</sup> Edition, 1993.
3. Albert Fleishman, Distributes Systems- Software Design and Implementation, Springer-Verlag, 1994
4. M.L.Liu, Distributed Computing Principles and Applications, Pearson Education, 2004.
5. Andrew S. Tanenbaum, Maarten van Steen, Distributed Systems –Principles and Paradigms, Pearson Education, 2002
6. Mugesh Singhal, Niranjana G Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Edition, 2001
7. Maozhen Li and Mark Baker, The Grid: Core Technologies, John Wiley & Sons, 2005

## **NIE 711 - WIRELESS COMMUNICATION NETWORKS**

### **UNIT I**

Introduction to Wireless Networks - Wireless Network Topologies - Characteristics of the Wireless Medium – GSM – Cellular Network concept - Cellular transmission principles – Typical cell layout – Signals – Transmission interference – Cell splitting - TDMA technology - CDMA technology – GPRS - Security in Wireless Networks.

### **UNIT- II**

Wireless LAN standard - Evolution of IEEE 802.11- Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) for the IEEE 802.11 WLANs – Physical Layer for IEEE 802.11 WLANs; Radio systems –IR Systems – Applications - RF Standards: DECT – Bluetooth –WATM – Home RF – HIPERLAN

### **UNIT III**

Wireless LAN technology - Bluetooth Specifications - Bluetooth Architectures - Bluetooth Protocols - Bluetooth Service Discovery - Bluetooth MAC - Bluetooth Packet Structure - Bluetooth Audio - Bluetooth Addressing - Bluetooth Limitations - Bluetooth Implementation.

### **UNIT IV**

The WAP Forum - WAP Service Model - WAP Protocol Architecture - WAP Programming Model - Cordless systems - Mobile IP - Mobile adhoc networks(MANET) – Wireless Routing Protocol - Cluster Switch Gateway Routing (CSGR) - Ad Hoc On-Demand Distance Vector Routing (AODV). Dynamic Source Routing (DSR) - Zone Routing Protocol (ZRP) - Source Tree Adaptive Routing (STAR).

### **UNIT V**

Introduction to Satellite Communication – Basic Transmission theory – Satellite Components – Communication subsystems - Satellite Link Design - Microwave Propagation on Satellite-Earth Paths – Satellite Services - INSAT, VSAT, Remote Sensing – Mobile satellite Network design – Mobile satellite services – DTH

### **REFERENCE BOOKS:**

1. William Stallings, Wireless communications and Networks, 2<sup>nd</sup> Edition, Pearson Education Asia, 2005.
2. Jochen Schiller, Mobile Communications, 2<sup>nd</sup> Edition, Addison-Wesley, 2000.
3. Theodoere S. Rappaport, Wireless Communications: Principles and Practice, Prentice Hall, 1996
4. Assuncion Santamaria, Francisco Lopez-Hernandez, “Wireless LAN Standards and Applications”, Artech House, 2001
5. Chai-Keong Toh, AdHoc Mobile Wireless Networks: Protocols and Systems, Addition Wesley, 2002.
6. Dennis Roddy, “Satellite Communications”, Third Edition, Mc Graw Hill International Editions,2006

## **NIE 712 - NETWORK MANAGEMENT**

### **UNIT I**

Network Management goals, organization, and functions - Network monitoring - Network control – SNMPv1 Network management organization and communication function models - structure of SNMP management information – standards – SNMPv2 system architecture – protocol - protocol specification - SNMPv3 architecture.

### **UNIT- II**

Remote Network monitoring-concepts - group management - RMON alarms and filters - packet capture group - practical issues - RMON2 protocol -practical issues – ATM network management – Telecommunication network management – TMN conceptual model – architecture - Network management applications.

### **UNIT III**

Need for encryption –Definitions - - Encryption Techniques – Simplified DES – differential and linear cryptanalysis – Triple DES – RC5 - Public-Private Key (PPK) Cryptography - Hash and Mac Algorithms - - Digital certificates - Digital signatures and authentication protocols – Cryptographic Algorithms in SNMPv3.

### **UNIT IV**

Intruders – Viruses, Worms, and related threats – Firewalls – Design principles – Trusted systems – Websecurity requirements – Secure sockets – IP security overview – IP security architecture – key management – Security management – SNMP-based security. Internet security – Threats to privacy – Packet sniffing – Spoofing – Fraudulent information collection – Fundamental elements of security – Security assurance concepts – Security technologies – Physical security – logical security – application layer security – Deterring threats.

### **UNIT V**

Security protocols – Transport layer protocols – SSL - Application layer protocols – E-mail based-PGP- S/MIME security protocols – Electronic payment protocols – SET – Proxy payments – Shopping experience protocols – Open trading protocols (OTP) – Open buying on the Internet (OBI) – Internet banking protocols – Open Financial exchange (OFX) – Electronic bill presentation and payment (EBPP) - SNMPv3 Security model and protocol.

### **REFERENCE BOOKS:**

1. Juanita Ellis, Tim Speed, and William Crowal, The Internet Security Guidebook: From Planning to Development, 2001.
2. Mani Subramanian, Network management: Principles and Practice, Addison Wesley, 2000.
3. Mark S. Merkow, Ken L. Wheeler, and James Breithaupt, Building SEI Applications for Secure Transactions, 2000
4. Moshe Rozenblit, Security for Telecommunications Network Management, Prentice Hall India, 2000.
5. William Stallings, Cryptography and Network Security: Principles and Practice, 2<sup>nd</sup> Edition, Prentice Hall, 2000.
6. William Stallings, Network Security Essentials: Applications and Standards, Pearson Education Asia, 2001.
7. William Stallings, SNMP, SNMPv2, SNMPv3, and RMON1 and 2, 3<sup>rd</sup> Edition, Person Education Asia, 1999.



## **NIE 651 - STORAGE AREA NETWORKS**

### **UNIT I**

Basic Networking Concepts and Topologies: OSI Reference Model, Common Network Devices, Network Topologies, MAC Standards - Need for Storage Networks - Storage Devices and Techniques – Evolution and benefits of SANs – SAN Components and Building Blocks – Fibre Channel Basics: Fibre Channel Topologies, Fibre Channel Layers, Classes of Service – SAN Topologies

### **UNIT- II**

SANs Fundamentals: SAN Operating Systems Software and Hardware – Types of SAN Technology: Technology and Configuration, High Scalability and Flexibility – Standards – Storage Management Challenges – Networked Storage – Implementation Challenges – Storage Subsystems for Video Services

### **UNIT III**

Storage Networking Architecture – Storage in Storage Networking: Challenges, Cost, Performance – Network in Storage Networking: Fibre Channel, Emerging SAN interconnect Technologies – Basic Software – Advanced Software – Backup Software – Implementation Strategies

### **UNIT IV**

Storage Network Management – In-Band management – Out-of-Band Management-SNMP-HTTP-TELNET – Storage Network Management Issues – Storage Resource Management – Storage Management – Storage, Systems, and Enterprise Management Integration

### **UNIT V**

Designing and building a SAN- Design considerations – Business requirements – Physical layout – Placement – Storage pooling – Data availability – Connectivity – scalability – migration – manageability – fault tolerance and resilience - prevention of congestion – routability- backup and restoration - SAN Security & iSCSI Technology – Basic security guidelines – implementing SAN security – Backup and restoration – iSCSI technology - Future of SANS

### **REFERENCE BOOKS:**

1. Meeta Gupta, “Storage Area Network Fundamentals”, Cisco Press, 2002
2. John R. Vacca, “The Essential Guide to Storage Area Networks”, Prentice Hall, 2002
3. Richard Barker, Paul Massiglia, ‘Storage Area Network Essentials’, John Wiley & Sons, Inc., 2002
4. Tom Clark, “Designing Storage Area Networks”, Addison Wesley Pearson Education (Second Edition)
5. Alex Goldman, “Storage Area Networks Fundamentals”, Cisco Press 2002
6. Christopher Poelker, “Storage Area Networks for Dummies”

## **NIE 652 - OPTICAL NETWORKS**

### **UNIT I**

Introduction to optical networks – Principles of optical transmission – Evolution of optical networks – Components and enabling technologies – Wavelength division multiplexing (WDM) – WDM network architectures, broadcast-and-select networks, linear lightwave networks, and wavelength routed networks – Issues in broadcast-and-select networks.

### **UNIT- II**

Static traffic routing in wavelength routed networks – Virtual topology design – problem formulation and algorithms - design of multifiber networks – Virtual topology reconfiguration – problem formulation - reconfiguration due to traffic changes - reconfiguration for fault restoration – Network provisioning.

### **UNIT III**

Dynamic traffic routing in wavelength routed networks – Routing and wavelength assignment algorithms – Centralized and distributed control – Wavelength convertible networks – converter placement and allocation problems.

### **UNIT IV**

Wavelength rerouting algorithms – Network survivability – backup multiplexing, link based restoration, path based restoration – Multicast traffic routing – source rooted trees.

### **UNIT V**

Next generation optical Internets – burst switching – packet switching (IP-over-WDM) – Photonic slot routing – Network control and management – Access Networks – PON, FTTC, FTTH – Recent advances – MPLS, MPLambdaS, optical virtual private networks.

### **REFERENCE BOOKS:**

1. B. Mukherjee, Optical Communication Networks, McGrawHill, 1997.
2. Rajiv Ramaswami and Kumar N. Sivarajan, Optical Networks: A Practical Perspective, 2<sup>nd</sup> Edition, Morgan Kaufmann, USA, 2001.
3. C. Siva Ram Murthy and Mohan Gurusamy, WDM Optical Networks: Concepts, Design, and Algorithms 2002, Prentice Hall, USA,

## **NIE 653 - CRYPTOGRAPHIC TECHNIQUES**

### **UNIT I**

Introduction to Network Security – OSI Security Architecture – Security Attacks – Intruders – Malicious Software - Kinds of security breaches – Plan of attack - Points of vulnerability – Methods of defense – Control measures – Effectiveness of controls - Security Objectives and Services

### **UNIT- II**

Classical Encryption techniques – Symmetric Cipher – Substitution Technique – Transposition Techniques – Steganography – Block Ciphers and Data Encryption Standards(DES) - Characteristics - Design Principles – Differential and Linear Cryptanalysis - Mode of Operation - Strength of DES - Multiple encryption and Triple DES - Advanced Encryption Standard

### **UNIT III**

Introduction to number theory – Public Key Cryptography – Principles -RSA algorithm – Key Management - Diffie-Hellman Key Exchange algorithm - Elliptic Curve Cryptography – Message Authentication and Hash Functions - Hash and MAC algorithms

### **UNIT IV**

Digital Signatures - Digital Signature standard - Digital Signature and Authentication Protocols - Authentication Applications – Kerberos – x.509 – Elliptic Curve cryptography - Trusted intermediaries – Security handshake pitfalls – IP Security – Overview – Architecture – Authentication Header – Key Management - Web Security.

### **UNIT V**

Security protocols – Transport layer protocols – Electronic mail security – S/MIME security protocol – Pretty Good Privacy – Virtual Private Network (VPN) – Tunneling – Bastion Host - Firewalls design principles – Intrusion Detection System - Trusted systems – Electronic payment protocols

### **REFERENCE BOOKS:**

1. William Stallings, “Cryptography and Network Security: Principles and Standards”, Prentice Hall India, 4rd Edition, 2006
2. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security: Private Communication in a public world”, Prentice Hall India, 2nd Edition, 2002
3. Charles P. Pleegeer, “Security in Computing”, Person Education Asia
4. William Stallings, “Network Security Essentials: Applications and standards”, Person Education Asia, 2000
5. Meeta Gupta, “Building a Virtual Private Network”, 2003

## **NIE 654 - E-COMMERCE TECHNOLOGIES**

### **UNIT I**

Introduction – Evolution - Technology overview – Needs for e-commerce - Internet as a business platform – The e-commerce infrastructure- value chains in electronic commerce.

### **UNIT- II**

Business Models and e-Commerce : Various business models associated with e-commerce – Advantages - Web based tools for electronic commerce – Web server requirements for e-commerce – feature sets – web server software and tools for e-commerce.

### **UNIT III**

Electronic payment systems : e-cash , electronic wallets, smart cards etc – credit cards payment acceptance and processing . e-commerce strategies : web auctions, virtual communities, web portals etc

Supply Chain Management and e-Commerce: Introduction to SCM – e-commerce implementation with SCM.

### **UNIT IV**

Security threats to e-commerce : various security threats – implementing security mechanisms in e-commerce – client security – server security – electronic transactions integrity – certification policies and practices.

### **UNIT V**

Legal and Ethical Issues in e-Commerce : - Global, Social, and Other Issues in e-Commerce Recent Trends – case studies.

### **REFERENCE BOOKS:**

1. Electronic Commerce Gary Schneider, James T. Perry, 2004.
2. Secure Electronic Commerce: Building the Infrastructure for Digital Signatures and Encryption (2nd Edition) Warwick Ford, Michael S. Baum, 2004.

## **NIE 655 - SEARCH ENGINES & OPTIMIZATIONS**

### **UNIT I**

Introduction to Web Search Engines: Roadmap - Architecture - Overview of Crawlers: Design - Working principles – Engineering the large scale crawlers : DNS caching, prefetching – Link extraction and normalization – Robot exclusion – Avoiding repetitions etc.

### **UNIT- II**

Indexing : The indexing process - Methodologies - Various Indexing Algorithms – Index compression techniques – stemming - Retrieval : Relevance ranking - Retrieval techniques - Various retrieval algorithms – Similarity search.

### **UNIT III**

Link Analysis: Need & Importance - Techniques. Clustering: Clustering of web search results : Formulation and approaches - Collaborative filtering techniques - Dynamic clustering - Query Optimization techniques

### **UNIT IV**

Social Network Analysis: Page Rank – HITS – Resource discovery on Web. Multimedia Retrieval in search engines Semantic Web and search engines - Focused crawling - Vertical search engines. Making your page visible to search engines - Search engine marketing techniques

### **UNIT V**

Recent Trends in search engine domain – Case studies – Implementation of search engine using appropriate technologies.

### **REFERENCE BOOKS:**

1. Mining the Web: Discovering Knowledge from Hypertext Data (Hardcover) By Soumen Chakrabarti, 2002
2. Understanding Search Engines: Mathematical Modeling and Text Retrieval (Software, Environments, Tools) Michael W. Berry, Murray Browne, 2005

# **NIE 656 - NETWORK INFRASTRUCTURE AND CYBER SECURITY**

## **UNIT I**

Local Area Network (LAN) Infrastructure - Bridges and Switches - IP Routing Topology - Controlling Data Movement with Filters and VLANs. Wide Area Network (WAN) Infrastructure - WAN Switching Technologies - WAN Transmission Technologies - WAN Connectivity Methods - Voice Over Data Systems. Planning, Implementing, and Maintaining a Network Infrastructure using TCP/IP - Network Security using IPSec and wireless devices. Infrastructure using Certificate Services, Performance monitoring – Clustering, planning backup and recovery strategies. Routing and Remote Access.

## **UNIT- II**

Windows 2000 Networking - Install and Configure Protocols - Network Bindings and Packet Filters – Dynamic Host Configuration Protocol(DHCP)-Scoping - DHCP Options - IP Routing - RIP Routing - OSPF & Static Routing - Demand – Dial Routing - Monitoring Traffic - LAN Internet Connection Sharing - Modem Internet Connection Sharing - IP Security - IPSec Assignment - DNS Overview - DNS Servers - DNS Monitoring - Certificate Management - Remote Access Services - RAS Policies - RAS and VPN. Windows Internet Naming Services(WINS) - WINS Monitoring.

## **UNIT III**

Design the infrastructure - Windows 2000 network services - Network implementation plan - Protocols supported by Windows 2000. Implementing TCP/IP – IP Addressing - IP Routing. Network Monitor - Windows 2000 Administration tools. DHCP Services - Installing DHCP Services for Remote Access Services - Troubleshooting DHCP. Remote Access Service - Configuring RAS - IP Routing on RAS. IPSec Protocol, Monitoring IPSec. Virtual Private Network - Creating VPN Interfaces - Point to Point Protocol - Using routing and Remote Access with DHCP. Managing and Monitoring Remote Access - Accounting - Net Shell. Network Address Translation (NAT) - Installing and configuring NAT.

## **UNIT IV**

Cyber Security : Secure Programming - Least-privilege programming and impersonation - Input cleanliness - Worm anatomy. OS security - Windows ACLs and security policies - Vista security additions - SE Linux domain type enforcement policies - Database Security. Network Security - Firewall configuration – IPSec - IPv6 - Network intrusion detection and monitoring - Honeypots - Wireless security Network scanning. Defensive system design - Security architectures - Penetration testing.

## **UNIT V**

Introduction to Cyber Crime and Security - Denial of Service Attacks - Malware - Encryption – Internet Fraud and Cyber Crime – Industrial Espionage in Cyberspace – Cyber Terrorism and Information Warfare – Cyber Detective. Legal aspects -Cyber Law and Ethics –Trust - Risks - Threats & Vulnerabilities – Management - Disaster Recovery - Key Management -Security Planning, Web security. Cyber attacks - Cyber warfare - Cyber terrorism - Cyber hooliganism, Slammer worm, Titan Rain, Administrative security - Network Security - Procedural Controls - Auditing & Monitoring - Role-Based Access Control (RBAC) - Systems Management Responsibilities.

## **REFERENCE BOOKS:**

1. Edward Amoroso - Cyber Security , Silicon Press, September 27, 2006
2. Author: Microsoft - Als Microsoft Windows 2000 Network Infrastructure Administration Subgenre: Certification Guides / General, John Wiley & Sons Inc (10/06/2006).
3. Steven Andres, Brian Kenyon - Security Sage's Guide to Hardening the Network Infrastructure Subgenre: Security / General, Networking / Network Protocols, Elsevier Science Ltd (07/01/2004)

## NIE 657 - ADVANCED NETWORK DESIGN AND PERFORMANCE TUNING

### UNIT I

**Advanced Networks Introduction:** Switching concepts; Switch forwarding techniques; switch path control - LAN switching; cut through forwarding; store and forward; ATM Switching Switch models - Blocking networks – basic and enhanced banyan networks - sorting networks – merge sorting - rearrangeable networks - full and partial connection networks - nonblocking networks – construction and comparison of non-blocking network.

### UNIT- II

**Queues and IP Switching:** Internal queuing – Input, output and shared queuing - multiple queuing networks –combined input, output and shared queuing – performance analysis of queued switches, Addressing mode - IP switching types-flow driven and topology driven solutions - IP Over ATM address and next hop resolution – multicasting - IPv6 over ATM.

### UNIT III

**Network Performance – Introduction:** Need for performance evaluation – Role of performance evaluation - performance evaluation Methods – Performance Metrics and Evaluation Criteria – CPU and I/O Architectures – Distributed and Network Architectures– Secondary Storage – Topologies – Computer Architecture - Fundamental Concepts and Performance Measures.

### UNIT IV

**NFS Performance Tuning:** NFS server constraints, NFS client improvements, NFS over WANs, Automounter and other tricks.

### UNIT V

**Network Performance Tuning:** Network Performance, Design and Capacity Planning: Locating bottlenecks, Demand management, Media choices and protocols, Network topologies: bridges, switches and routers, Throughput and latency considerations, Modeling resource usage.

### REFERENCE BOOKS:

1. Ranier Handel, Manfred N Huber, Stefan Schrodder. ATM Networks-concepts, protocols, applications, 3<sup>rd</sup> Edition, Adisson Wesley, New York,1999.
2. Achille Patavina, Switching Theory: Architectures and performance in Broadband ATM Networks. John Wiley & Sons Ltd., New York.1998.
3. Christopher Y Metz, Switching protocols & Architectures. McGraw Hill, New York.1998.
4. Thomas G. Robertazzi, “Computer Networks and Systems: Queueing theory and Performance Evaluation”, Third Edition, Springer, 2000.
5. Domenico Ferrari , Giuseppe Serazzi ,Alexandro Zeijher, Measurement & Tuning of Computer Systems –Prentice Hall Inc,1983.

# NIE 658 – PERVASIVE AND UBIQUITOUS COMPUTING

## UNIT I

### Introduction

Pervasive computing - View of pervasive computing – Consequences for Pervasive networks.  
**Privacy:** User Awareness – context – accessibility – authentication.

## UNIT – II

### SECURITY IN PERVASIVE COMPUTING

**Security:** Secure services – registration/deregistration– secure discover & Secure delivery – authenticated – authorized – confidential – genuine – anonymous – application security.

**Physical security:** Identification and authentication– network operation – protection for layers – routing – network management – security.

**Security Technologies:** Public Key Infrastructure (PKI) – terms of PKI – Simple Public Key Infrastructure (SPKI) – terms of SPKI – Role Based Access Control (RBAC) – terms of RBAC.

**Public key Infrastructure:** Password based public key infrastructure – Prior context– Diffie – Hellman method – Self organized public key infrastructure – Graph– Trust graph.

## UNIT III

### ISSUES, CHALLENGES AND ATTACKS

9

**Issues:** Authentication vs. Recognition – Identity management – Security and Availability – Dynamic Trust model and Context – awareness – Privacy Issues.

**Assumptions made in security analysis:** Social basis – threat assumptions – existence of a trusted computing base

**Challenges:** Challenges on attacks – computation power – lack of clarity and firewall approach.

**Attacks:** Software attacks – description – drawbacks – Physical attacks – Invasive probing – non-invasive probing– non-invasive measurements – Environmental attacks.

## UNIT IV LOCAL AREA AND WIDE AREA WIRELESS TECHNOLOGIES

9

IEEE 802.11 technologies – Infrared technologies – Bluetooth networks (OBEX Protocol) – Personal Area Networks – Mobility Management – Mobile IP – Establishing Wide area wireless networks – Concept and structure of "cell" – Call establishment and maintenance – Channel management – Frequency Assignment techniques.

## UNIT V PROTOCOLS AND APPLICATIONS

9

Networking protocols – Packet switched protocols – Routing Protocols for Sensor Networks – Data Centric Protocols – Hierarchical Protocols – Location – based protocols – Multimedia Messaging Service (MMS) Protocols – Wireless Application Protocol (WAP) – Applications of Pervasive Computing – Retail – Healthcare – Sales force automation – Tracking applications.



## REFERENCES

1. Akkins, Derk, "Internet security professional reference", 2<sup>nd</sup> edition, Techmedia publications, 1997.
2. Scott, Charlie, "Virtual privacy networks", O'Reilly publication, 2000.
3. Swaminathan. Tara and Elden, Charles, "Wireless security and privacy", Pearson education Asia publication, 2003
4. F.Adelstein, S.K.S. Gupta, "Fundamentals of Mobile and Pervasive Computing" Tata McGraw Hill, 2005.
5. Ashoke Talukdar and Roopa Yavagal, "Mobile Computing", Tata McGraw Hill, 2005

## NIE 659 – INFORMATION STORAGE ARCHITECTURE

### Unit – I

**Concepts of Storage Networking:** The Data Storage and Data Access Problem - The Battle for Size and Access - Decoupling the Storage Component: Putting Storage on the Network - Decoupling the Storage Component: Creating a Network for Storage

### Unit – II

**Storage Fundamentals:** Storage Architectures - Device Overviews - Connectivity Options - Data Organizational Methods

### Unit – III

**Network Attached Storage:** Putting Storage on the Network: A Detailed Discussion - NAS Hardware Devices - NAS Software Components - NAS Connectivity Options

### Unit- IV

**Storage Area Networks:** Architecture Overview - Hardware Devices - Software Components - Configuration Options for SANs

### Unit V

**Application & Management** -Putting It Together - Defining the I/O Workload - Applying the SAN Solution - Applying the NAS Solution - Considerations When Integrating SAN and NAS - Planning Business Continuity - Managing Availability

## REFERENCES

1. Storage Networks, The Complete Reference, Robert Spalding Tata Mcgraw-Hill Publishing Company Ltd, 2003
2. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
3. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

# NIE 660 – SENSOR NETWORKS

## UNIT I

### SENSOR NETWORKS

Sensor Networks: A Bridge to the Physical World - Introduction to various sensors like Temperature – Humidity – Pressure – Introduction to Sensor networks – motivation – applications – sensors – architectures – and platforms for Wireless sensor networks – Sensor Node Architecture – Sensor Network Architecture – Sample sensor networks applications – Design challenges – Performance metrics

## UNIT II LOCALIZATION AND TRACKING

A tracking scenario – sensing model – Collaborative localization – Bayes state estimation – distributed representation – Tracking multiple objects – Ranging techniques – Range based localization algorithms – location services

## UNIT – III

**Data Storage and Manipulation & Security** . Data-centric Routing and Storage in Sensor Network - Compression Techniques for Wireless Sensor Networks

**Security**. Security for Wireless Sensor Networks- Key Distribution Techniques for Sensor Networks- Watermarking Techniques.

## UNIT IV

### NETWORKING SENSORS AND NETWORK PLATFORMS

MAC for sensor networks – Geographic – Energy – aware routing – Attribute – based routing – Sensor node Hardware (Berkeley Motes) – TinyOS – nesC – Tiny GALS – NS – 2 – TOSSIM – PIECES.

## UNIT V

### RFID BASICS

Introduction – transponder and reader architecture – types of tags and readers – frequencies of operation – selection criteria for RFID systems – information processing in the transponder and reader – fundamental operating principles – antennas for RFIDs.

### REFERNCES

1. Handbook of Sensor Networks: Compact Wireless and Wired Sensing Systems, Mohammad Ilyas, Imad Mahgoub , CRC Press, 2005
2. Wireless Sensor Networks, F. Zhao and L. Guibas, Morgan Kaufmann, San Francisco, 2004.

## **NIE 661 – EMBEDDED SYSTEMS**

### **UNIT I          FUNDAMENTAL DESIGN ASPECTS**

Embedded design life cycle – Product Specification – Hardware Software Partitioning – Design and Integration – Selection Process – Performance Evaluation Tools – Benchmarking – RTOS Microcontroller – RTOS availability – Tool Chain availability – Hardware Software Duality – Coding Hardware – ASIC – Managing the Risk – Co verification – execution environment – Memory organization – interfacing and management – system start – up – speed and code density.

### **UNIT II          PROCESS MODELS AND CO DESIGN**

Modes of Operation – Finite State Machines – Models – HCFSLs and State charts Language – state machine models – Concurrent Process Models – Interprocess Communication – Synchronisation Implementation – Data Flow Model – Design Technology – Automation Synthesis – Hardware Software co simulation – IP cores – Design Process Model.

### **UNIT III          INSTRUCTION SET ARCHITECTURE**

Advanced Digital Design – CPU Structure and Architecture (DATA PATH AND CONTROLLER PORTION Harvard architecture/Super Harvard ARCHitecture (SHARC) – Characteristics of DSP processors – SIMD – ILP AND VLIW) – Example Processors (MCS51 FAMILY, ARM, DSP, POWER PC, PENTIUM, PIC ETC), Modern reconfigurable IO designs for implementation of processing elements – Overview of 8051 – ARM Processor Architecture – instruction sets – Thumb instruction sets – DSP Processors – Parallel processing – DMA – Data operators – Saturation arithmetic – sticky bits – MAC operations – Pipelining – Example processors.

### **UNIT IV          EMBEDDED SOFTWARE**

Analysis of application level software – Middle layer communication related software: OSI Reference Model – Embedded Communication System – Software, Layer 1 and 2 Switch / Routers – Protocol Implementations like CAN and I2C – Wifi – WiMax, Bluetooth – etc – Third Party Protocol Libraries. Device and Router Management – Management of Subsystem Architecture – System Start up and Configuration. Operating system related software, Hardware related (Interrupt Service Routines – Scheduler: Inter Process Communication – device drivers and kernel level software)

### **UNIT V          EMBEDDED SYSTEM VERIFICATION AND VALIDATION**

Requirement analysis (functional and non – functional) – Verification and validation Basic toolset – Host based debugging – Remote debugging – ROM emulators – Logic Analyzer – Caches – Computer Optimisation – Statistical profiling – In circuit emulators – Buffer control – Real – Time trace – Hardware break points – Overlay memory – Timing Constraints – Usage Issues – Triggers.

### **REFERENCES**

1. Frank Vahid and Tony Gwargie, “Embedded System Design”, John Wiley & Sons 2002
2. Arnold S. Berger, “Embedded System Design”, CMP Books USA 2002.
3. David.E.Simon, “An Embedded Software Primer”, Pearson Education 2001.
4. Steve Heath, “Embedded System Design”, 2nd Edition, Elsevier 2004.

## **NIE 662 – CLOUD COMPUTING**

### **UNIT – I**

Cloud Computing

The Cloud – Cloud Versus Grid - Cloud Application Architectures - Cloud Computing components - Cloud Infrastructure Models - An Overview of Amazon Web Services

### **UNIT – II**

Amazon Cloud Computing - Amazon S3 - Amazon EC2 - Before the Move into the Cloud  
- The Shift to a Cloud Cost Model - Service Levels for Cloud Applications - Security - Disaster Recovery

### **UNIT – III**

Ready for the Cloud - Web Application Design - Machine Image Design - Privacy Design  
- Database Management

### **UNIT – IV**

Security - Data Security - Network Security - Host Security - Compromise Response

### **UNIT – V**

Disaster Recovery - Disaster Recovery Planning - Disasters in the Cloud - Disaster Management.  
Scaling a Cloud Infrastructure - Capacity Planning - Cloud Scale

### **REFERENCES**

1. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud (Theory in Practice (O'Reilly))  
By George Reese

## **NIE 663 – REAL TIME SYSTEM**

### **Unit – I**

**Introduction:** Concept of Real Time System, Issues in real time computing, Performance measures of Real Time System, Issues in Real Time Computing, Performance measures of Real time Systems, Real Time Application.

**Task Assignment and Scheduling:** Different task model, Scheduling hierarchy, offline vs Online Scheduling, Clock Drives.

### **Unit – II**

**Model of Real Time System:** Processor, resources, temporal parameter, Periodic Task Model, Sporadic Task Model, Precedence Constraints and Data Dependencies, Scheduling hierarchy

**Scheduling of Periodic Task:** Assumptions, fixed versus dynamic priority algorithms, schedulability test for fixed priority task with arbitrary deadlines.

### UNIT - III

**Scheduling of Aperiodic and Sporadic Tasks:** Assumptions and approaches, deferrable, sporadic servers, slack stealing in deadline driven and fixed priority systems. Two level schemes for integrated scheduling, Scheduling for applications having flexible constraints.

**Resources and Resource Access Control:** Assumptions on resources and their usage, resource contention, resource access control (Priority Ceiling Protocol, Priority Inheritance protocol, Slack Based Priority Ceiling Protocol, Preemption Ceiling Protocol).

### UNIT - IV

**Multi Processor Scheduling:** Model of multi processor and distributed systems, scheduling algorithms for end to end periodic tasks in homogeneous/heterogeneous systems, Predictability and validation of dynamic multiprocessor system.

### UNIT - V

**Real time Communication:** Model of real time Communication, Priority base service

For switched network, Weighted Round Robin Service, Medium access Control Protocol, Real Time Protocol.

### REFERENCES :

1. Jane .W. S. Liu “Real Time Systems” Pearson Education.
2. Krishna .C.M “Real Time Systems” Mc-Graw Hill Publication.

## NIE 664 – BIO - METRIC BASED SECURITY SYSTEMS

### UNIT I

**Introduction to Biometrics Authentication:** Biometrics authentication Traditional methods for personal authentication. Some definitions of biometrics authentication technologies and systems. Software and hardware biometrics systems. Image processing and pattern recognition in living body, including human head & face, the mechanism of human eye, hand & skin characteristics.

### UNIT II

**Biometrics Sensors and Data Acquisition:** Biometric data acquisition and database. **Biometrics Pre-processing:** The related biometrics preprocessing technologies, including: noise removing, edge sharpening, image restoration, image segmentation, pattern extraction and classification.

### UNIT III

**Biometrics Feature Extraction:** Basic elements in pattern recognition system, and some basic introduction of pattern recognition systems on biometrics (such as fingerprint, palm-print, finger, hand, face, iris, and face, as well as dental, DNA, and retina recognition). **Features Matching and Decision Making:** Various matching methods, including PCA and LDA. Introduce decision theory and their examples.

### UNIT IV

**Design and Implementation of Biometric Systems**

Basic approaches of automated biometrics identification and verification systems. Various performance comparison and their analysis for large population authentication, accuracy and reliability of authentication in an *e*-world.

## **UNIT V**

### **Biometric Authentication Applications**

Various applications, including access control like a lock or an airport check-in area; immigration and naturalization; welfare distribution; military identification; banking, e.g., check cashing, credit card, ATM (automated teller machine); computer login; intruder detection; smart card; multi-media communication; WWW and an electronic purse; sensor fusion; decision fusion; categorization: e.g., age and gender; industrial automation; gesture interpretation; efficient enrollment; audio-visual tracking; stock market; on-line shopping; compact embedded systems and other commercialized services.

### **REFERENCES :**

- Zhang, D., 2000, Automated Biometrics: Technologies & Systems, Kluwer Academic Publisher, USA.  
Zhang, D., 2003, Palmprint Authentication, Kluwer Academic Publishers, USA.  
Zhang, D (ed.), 2002, Biometrics Solutions for Authentication in an e-World, Kluwer Academic Publishers, USA.  
Jain, et al., (eds), 1999, Biometrics: Personal Identification in Networked Society, Kluwer Publisher.  
Sid-Ahmed, M.A., 1995, Image Processing, Theory, Algorithms, & Architectures, McGraw-Hill.  
Awcock. G.W., et al., 1996, Applied Image Processing, McGraw-Hill.  
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IEEE Transaction on Image Processing.

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