

**AFFILIATED INSTITUTIONS  
ANNA UNIVERSITY ,CHENNAI  
REGULATIONS - 2009  
CURRICULUM and SYLLABI – II TO IV SEMESTERS  
M.E. COMPUTER NETWORKING AND ENGINEERING**

**SEMESTER II**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	CS 9251	<u>Mobile Computing</u>	3	0	0	3
2	MP 9221	<u>Wireless Sensor Networks</u>	3	0	0	3
3	NW 9323	Wireless Networks	3	0	0	3
4	CP9212	<u>High Performance Computer Networks</u>	3	0	0	3
5	E2	Elective II	3	0	0	3
6	E3	Elective III	3	0	0	3
<b>PRACTICAL</b>						
7	NE9227	<u>Wireless Network Lab</u>	0	0	4	2
<b>TOTAL</b>			<b>18</b>	<b>0</b>	<b>4</b>	<b>20</b>

**SEMESTER III**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>THEORY</b>						
1	E4	Elective IV	3	0	0	3
2	E5	Elective V	3	0	0	3
3	E6	Elective VI	3	0	0	3
<b>PRACTICAL</b>						
4	NW9331	Project Work (Phase I)	0	0	12	6
<b>TOTAL</b>			<b>9</b>	<b>0</b>	<b>12</b>	<b>15</b>

**SEMESTER IV**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
<b>PRACTICAL</b>						
1	NW9341	Project Work (Phase II)	0	0	24	12
<b>TOTAL</b>			<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL NO. OF CREDITS TO BE EARNED FOR THE AWARD OF DEGREE = 68**

## LIST OF ELECTIVES

### M.E. COMPUTER NETWORKING AND ENGINEERING

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	NW9001	<u>Advanced Networks</u>	3	0	0	3
2	NE9251	<u>Reliability Engineering</u>	3	0	0	3
3	AP9252	<u>Neural Networks and Its Applications</u>	3	0	0	3
4	NE9253	<u>Real-Time Embedded Systems</u>	3	0	0	3
5	NE9254	<u>Software Engineering Methodologies</u>	3	0	0	3
6	CS9225	<u>Web Technology</u>	3	0	0	3
7	CP9253	<u>High Speed Switching Architecture</u>	3	0	0	3
8	NE9256	<u>Genetic Algorithms and Applications</u>	3	0	0	3
9	CU9224	<u>Satellite Communication</u>	3	0	0	3
10	NE9257	<u>Multimedia Compression Technologies</u>	3	0	0	3
11	NE9258	<u>Advanced Algorithms</u>	3	0	0	3
12	NE9259	<u>Telecommunication and Switching Techniques</u>	3	0	0	3
13	NE9260	<u>Storage Area Networks</u>	3	0	0	3
14	NE9261	<u>Enterprise Networks</u>	3	0	0	3
15	NE9262	<u>Optical Communication Systems and Networking</u>	3	0	0	3
16	NE9263	<u>Distributed Computing</u>	3	0	0	3
17	CS9256	<u>Multimedia Systems</u>	3	0	0	3
18	CS9266	<u>Agent Based Intelligent Systems</u>	3	0	0	3
19	NE9266	<u>Simulation of Communication Systems and Networks</u>	3	0	0	3
20	NW9003	<u>Network Processor</u>	3	0	0	3
21	CS9254	<u>Soft Computing</u>	3	0	0	3
22	NW9004	<u>Cryptography &amp; Network Security</u>	3	0	0	3
23		<u>Special Elective</u>				

**UNIT 1 WIRELESS COMMUNICATION FUNDAMENTALS 9**

Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

**UNIT II TELECOMMUNICATION SYSTEMS 11**

GSM – System Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Handover – Security – GPRS.

**UNIT III WIRELESS NETWORKS 9**

Wireless LAN – IEEE 802.11 Standards – Architecture – Services – HIPERLAN – Adhoc Network – Blue Tooth.

**UNIT IV NETWORK LAYER 9**

Mobile IP – Dynamic Host Configuration Protocol – Routing – DSDV – DSR – AODV – ZRP – DMR.

**UNIT V TRANSPORT AND APPLICATION LAYERS 7**

TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP – WAP – WAP Architecture – WDP – WTLS – WTP – WSP – WML –WML Script – WAE – WTA.

**TOTAL: 45 PERIODS****REFERENCES**

1. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2003.
2. William Stallings, "Wireless Communications and Networks", Pearson Education, 2002.
3. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", First Edition, Pearson Education, 2003.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
5. C.K.Toth, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
6. Burkhardt, "Pervasive Computing", First Edition, Pearson Education, 2003.

**UNIT I INTRODUCTION 9**

Challenges for wireless sensor networks, Comparison of sensor network with ad hoc network, Single node architecture – Hardware components, energy consumption of sensor nodes, Network architecture – Sensor network scenarios, types of sources and



- UNIT I WIRELESS LANS, PANS AND MANS 9**  
Introduction, fundamentals of WLAN –technical issues, network architecture, IEEE 802.11- physical layer, Mac layer mechanism, CSMA/CA, Bluetooth- specification, transport layer, middleware protocol group, Bluetooth profiles, WLL –generic WLL architecture, technologies, broadband wireless access, IEEE 802.16 –differences between IEEE 802.11 and 802.16,physical layer, data link layer.
- UNIT II WIRELESS INTERNET 9**  
Introduction –wireless internet, address mobility, inefficiency of transport layer and application layer protocol, mobile IP – simultaneous binding, route optimization, mobile IP variations, handoffs, IPv6 advancements, IP for wireless domain, security in mobile IP, TCP in wireless domain – TCP over wireless , TCPs -traditional, snoop, indirect, mobile, transaction- oriented, impact of mobility.
- UNIT III AD-HOC WIRELESS NETWORK AND WIRELESS SENSOR NETWORK 9**  
Introduction, issues –medium access scheme, routing, multicasting, transport layer protocol, pricing scheme, QoS provisioning, self-organization, security, addressing, service discovery, energy management, deployment consideration, ad-hoc wireless internet.
- UNIT IV WIRELESS SENSOR NETWORK 9**  
Introduction – applications of sensor network, comparisons with MANET, issues and design challenges, architecture – layered and clustered , data dissemination, data gathering, Mac protocols, location discovery, quality of sensor network – coverage and exposure, zigbee standard.
- UNIT V RECENT ADVANCES IN WIRELESS NETWORK 9**  
UWB radio communication- operation of UWB systems, comparisons with other technologies, major issues, advantages and disadvantages, wi-fi systems- service provider models, issues, interoperability of wi-fi and WWAN, multimode 802.11 – IEEE 802.11a/b/g – software radio-based multimode system, meghadoot architecture -802.11 phone, fundamentals of UMTS.

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. C.Siva Ram Murthy and B.S. Manoj, “Ad-hoc wireless networks-architecture and protocols”, Pearson education, 2<sup>nd</sup>, 2005.
2. Kaveh Pahlavan and Prashant Krishnamurthy, “Principle of Wireless network- A unified approach”, Prentice Hall, 2006.
3. Jochen Schiller, “Mobile Communication”, Pearson education, 2nd edition 2005.
4. William Stallings, “Wireless Communication and Networks”, Prentice Hall, 2<sup>nd</sup> edition, 2005.
5. Clint Smith and Daniel Collins, “3G wireless networks”, Tata Mcgraw Hill, 2<sup>nd</sup> edition, 2007.



**I. Using CDMA Spread Spectrum Trainer**

- 1) Embedded wireless solutions using CDMA network
- 2) GPS integrated GSM modules using SMS for in tracking & remote monitoring applications

**II. Using GPS Trainer**

- 3) Embedded GPS modules interfaced with other embedded modules for location based applications
- 4) GPS integrated GSM modules using SMS for in tracking & remote monitoring applications

**III. Using GSM Trainer**

- 5) Developing GSM board+ SIM card based applications emulating mobile phones (Eg. Mobile ATM Vans)
- 6) SMS based remote monitoring/control applications using existing GSM network

**IV. Using Bluetooth Trainer**

- 7) Bluetooth based wireless personal area networking (WPAN) – printers, mouse, keypads, and mobiles
- 8) Combining RFID and Bluetooth

**V. Mobile Communication Trainer MT2000**

- 9) Can be used as stand alone or full product development kit in 49 MHz ISM band

**VI. RFID Development Kit**

- 10) Tag all assets inside Embedded Wireless Lab with RFID
- 11) Use of passive and active tags for Library Management system

**VII. Smart Wireless Applications & Wireless Sensor Networks**

- 12) Remote door locks and gate openers

## **Requirement for a batch of 25 students**

1. CDMA Trainer	2 Nos
2. GPS Trainer	2 Nos
3. GSM Trainer	2 Nos
4. Bluetooth Trainer	2 Nos.
5. RFID Trainer	2 Nos
6. MT2000	2 Nos
7. Ptolemy (free software)	2 Nos

**TOTAL : 60 PERIODS**

**NW9001**

**ADVANCED NETWORKS**

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3 0 0 3**

### **UNIT I INTRODUCTION**

**9**

Communicating in the New Era- IP Everywhere- Optical Anywhere- Wireless through the Air- Building Blocks for Next-Generation Networks- IP Networks- Multiservice Networks- VPNs- Optical, Wire line & Wireless Networks- Using Next-Generation Network Services- Network Infrastructure Convergence- Services Convergence- IP Networks

### **UNIT II LAYER 2 AND LAYER 3 VPN**

**9**

Layer 2 Internetworking, VPN Service, Provisioning-Benefits of L2VPN, Inter-AS L2VPN, Supported IETF Standards-Technology Overview-Intranet Corporate-Internet Access-Scaling MPLS VPNs to Multi-AS, Multi-Provider, and Hierarchical Networks- Heterogeneous Networks-Managed Central Services

### **UNIT III WIRE LINE & WIRELESS NETWORKS**

**9**

Narrowband-Squeezing Voice and Data-Residential Loop for Analog Transmission- Going Digital with PCM and TDM-Narrowband Aggregation for DS1 and E1-ISDN-Frame Relay-Narrowband Aggregation Layer and Digital Loop Carriers-Broadband-Pushing Technology to the Edge-DSL-DSLAM Broadband Aggregation Layer-Wireless Optics-Fixed Wireless-Satellite Wireless.

### **UNIT IV MULTISERVICE NETWORKS**

**9**

Global IP Networks-Global Capacity-Globally Resilient IP- Beyond IP- Multiservice Networks-The Origins of Multiservice ATM-Next-Generation Multiservice Networks-Next-Generation Multiservice ATM Switching-Multiprotocol Label Switching Networks Multiservice Core and Edge Switching -Frame-Based & cell based MPLS -MPLS Benefits and Services -Next-Generation Multiservice Routers- -MSSP- Multiservice Transport Platform (MSTP)- MPLS Security

**UNIT V MULTICAST AND NGN NETWORK MANAGEMENT 9**  
 MPLS Multicast VPN -Multicast Security and Management Considerations-Network Management and Provisioning-Fault ,Configuration Accounting, Performance Management, and Security Management for MPLS-Aware ICMP Ping and LSP Ping/Trace Mechanisms-Dealing with Equal Cost Multipaths-Virtual Circuit Connection Verification and Bidirectional Forwarding Detection-Generic Failure Types-Interoperability of services and network in NGN- Numbering, naming and addressing of NGN.

**TOTAL : 45 PERIODS**

**REFERENCES:**

1. Azhar Sayeed, Monique Morrow “MPLS and Next-Generation Networks: Foundations for NGN and Enterprise Virtualization” Cisco Press, Paperback, and Published November 2006, 300 pages.
2. Jyh-Cheng Chen ,Tao Zhang “MPLS and IP-Based Next-Generation Wireless Networks: Systems, Architectures, and Protocols” Hardcover. Year of Publication: 2003
4. Robert Wood “Next-Generation Network Services”, cisco press, Year of Publication Nov 2005

**NE9251 RELIABILITY ENGINEERING L T P C  
 3 0 0 3**

**UNIT I PROBABILITY PLOTTING AND LOAD-STRENGTH INTERFERENCE 9**  
 Statistical distribution , statistical confidence and hypothesis testing ,probability plotting techniques – Weibull, extreme value ,hazard, binomial data; Analysis of load – strength interference , Safety margin and loading roughness on reliability.

**UNIT II RELIABILITY PREDICTION, MODELLING AND DESIGN 9**  
 Statistical design of experiments and analysis of variance Taguchi method, Reliability prediction, Reliability modeling, Block diagram and Fault tree Analysis ,petric Nets, State space Analysis, Monte carlo simulation, Design analysis methods – quality function deployment, load strength analysis, failure modes, effects and criticality analysis.

**UNIT III ELECTRONICS AND SOFTWARE SYSTEMS RELIABILITY 9**  
 Reliability of electronic components, component types and failure mechanisms, Electronic system reliability prediction, Reliability in electronic system design; software errors, software structure and modularity, fault tolerance, software reliability, prediction and measurement, hardware/software interfaces.

**UNIT IV RELIABILITY TESTING AND ANALYSIS 9**  
 Test environments, testing for reliability and durability, failure reporting, Pareto analysis, Accelerated test data analysis, CUSUM charts, Exploratory data analysis and proportional hazards modeling, reliability demonstration, reliability growth monitoring.

**UNIT V MANUFACTURE AND RELIABILITY MAQNAGEMENT 9**

Control of production variability, Acceptance sampling, Quality control and stress screening, Production failure reporting; preventive maintenance strategy, Maintenance schedules, Design for maintainability, Integrated reliability programmes , reliability and costs, standard for reliability, quality and safety, specifying reliability, organization for reliability.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Patrick D.T. O'Connor, David Newton and Richard Bromley, Practical Reliability Engineering, Fourth edition, John Wiley & Sons, 2002
2. David J. Klinger, Yoshinao Nakada and Maria A. Menendez, Von Nostrand Reinhold, New York, "AT & T Reliability Manual", 5th Edition, 1998.
3. Gregg K. Hobbs, "Accelerated Reliability Engineering - HALT and HASS", John Wiley Sons, New York, 2000.
4. Lewis, "Introduction to Reliability Engineering", 2nd Edition, Wiley International, 1996.

**AP9252 NEURAL NETWORKS AND ITS APPLICATIONS LT P C  
3 0 0 3**

**UNIT I BASIC LEARNING ALGORITHMS 9**

Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feedforward and Feedback – Learning Process: Error Correction Learning –Memory Based Learning – Hebbian Learning – Competitive Learning - Boltzman Learning – Supervised and Unsupervised Learning – Learning Tasks: Pattern Space – Weight Space – Pattern Association – Pattern Recognition – Function Approximation – Control – Filtering - Beamforming – Memory – Adaptation - Statistical Learning Theory – Single Layer Perceptron – Perceptron Learning Algorithm – Perceptron Convergence Theorem – Least Mean Square Learning Algorithm – Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm.

**UNIT II RADIAL-BASIS FUNCTION NETWORKS AND SUPPORT VECTOR MACHINES RADIAL BASIS FUNCTION NETWORKS 9**

Cover's Theorem on the Separability of Patterns - Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks - Applications: XOR Problem – Image Classification.

Support Vector Machines:

Optimal Hyperplane for Linearly Separable Patterns and Nonseparable Patterns – Support Vector Machine for Pattern Recognition – XOR Problem -  $\infty$ -insensitive Loss Function – Support Vector Machines for Nonlinear Regression

**UNIT III COMMITTEE MACHINES 9**

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model(HME) – Model Selection using a Standard Decision Tree – A Priori and Postpriori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model - EM Algorithm – Applications of EM Algorithm to HME Model



**UNIT I INTRODUCTION****10**

Real Time System – Embedded Systems – Architecture of Embedded System - Simple Programming for Embedded System – Process of Embedded System Development - Pervasive Computing – Information Access Devices – Smart Cards – PIC Microcontroller – ARM Processor.

**UNIT II EMBEDDED/REAL TIME OPERATING SYSTEM****9**

Operating System Concepts: Processes, Threads, Interrupts, Events - Real Time Scheduling Algorithms - Memory Management – Overview of Operating Systems for Embedded, Real Time, Handheld Devices – Target Image Creation – Programming in Linux, RTLinux, VxWorks, uC/Os-overview.

**UNIT III CONNECTIVITY****9**

Wireless Connectivity - Bluetooth – Other short Range Protocols – Wireless Application Environment – Service Discovery – Middleware.

**UNIT IV REAL TIME UML****8**

Requirements Analysis – Object Identification Strategies – Object Behavior – Real Time Design Patterns.

**UNIT V SOFTWARE DEVELOPMENT AND CASE STUDY****9**

Concurrency – Exceptions – Tools – Debugging Techniques – Optimization – Case Studies -Interfacing Digital Camera with USB port and Data Compressor.

**TOTAL: 45 PERIODS****REFERENCES**

1. R.J.A.Buhr, D.L.Bailey, “An Introduction to Real-Time Systems”, Prentice-Hall International, 1999.
2. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007. (UNIT – II) C.M.Krishna, Kang G.Shin, “Real Time Systems”, Mc-Graw Hill, 1997. (UNIT- II)
3. B.P.Douglass, “Real Time UML 2<sup>nd</sup> Edition”, Addison-Wesley 2000. ((UNIT – IV)
4. J.Schiller, “Mobile Communication”, Addison-Wesley, 1999. (UNIT – III)
5. Dr.K.V.K.K.Prasad, “Embedded/Real Time Systems: Concepts, Design and Programming”, DreamTech press, Black Book, 2005. (UNIT – I)
6. R.Barnett, L.O.Cull, S.Cox, “Embedded C Programming and the Microchip PIC”, Thomason Learning 2004. (UNIT – I)
7. Wayne Wolf, “Computers as Components - Principles of Embedded Computer System Design”, Mergen Kaufman Publisher, 2006.
8. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc-Graw Hill, 2004.

**UNIT I****9**

Definition – systems approach – modeling the process and lifecycle – meaning of process – software process models – tools and techniques – practical process modeling – information systems – planning and managing the project – tracking project – project personnel – effort estimation – risk management – project plan – process models and project management

**UNIT II****9**

Capturing the requirements – requirements process – requirements elicitation – types – characteristics – modeling notations – specification languages – prototyping – documentation – validation and verification – measures – specification techniques – designing the system – decomposition and modularity – architectural styles and strategies – issues – characteristics – improvement techniques – design evaluation, validation – documentation

**UNIT III****8**

Considering objects – object orientation – OO development – use cases – representing OO – OO system design – program design – OO measurement – writing programs – standards – procedures – guidelines – documentation – programming process

**UNIT IV****9**

Testing the program – faults – failures – issues – unit testing – Integration testing – testing OO systems – test planning – automated testing tools - testing the system – principles – function testing – performance testing – reliability, availability and maintainability – acceptance testing – installation testing – automated system testing – test documentation – testing safety critical systems – delivering the system – training – documentation

**UNIT V****10**

System maintenance – the changing system – nature of maintenance – problems – measuring maintenance characteristics – techniques and tools – software rejuvenation – evaluation approaches – selection – assessment vs. prediction - evaluating products, processes and resources – improving predictions, products, processes and resources – guidelines – decision making in software engineering – licensing – certification and ethics

**TOTAL: 45 PERIODS****REFERENCES**

1. Shari Lawrence Pfleeger, Joanne M. Atlee, Software Engineering: Theory and Practice, Prentice Hall, 2006
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, Prentice Hall, 2002

**UNIT I****9**

Web essentials – clients – servers - communication – markup languages – XHTML – simple XHTML pages style sheets – CSS

**UNIT II****9**

Client side programming – Java script language – java script objects – host objects : Browsers and the DOM

**UNIT III****9**

Server side programming – java servlets – basics – simple program – separating programming and presentation – ASP/JSP - JSP basics ASP/JSP objects – simple ASP/JSP pages.

**UNIT IV****9**

Representing Web data – data base connectivity – JDBC – Dynamic Web pages – XML – DTD – XML schema – DOM – SAX – Xquery.

**UNIT V****9**

Building Web applications - cookies – sessions – open source environment – PHP – MYSQL – case studies.

**TOTAL: 45 PERIODS****REFERENCES**

1. Jeffrey C Jackson, “ Web Technology – A computer Science perspective”, Persoson Education, 2007.
2. Chris Bates, “Web Programming – Building Internet Applications, “Wiley India, 2006.

**UNIT I LAN SWITCHING TECHNOLOGY****9**

Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs.

**UNIT II ATM SWITCHING ARCHITECTURE****9**

Blocking networks - basic - and- enhanced banyan networks, sorting networks - merge sorting, re-arrangable networks - full-and- partial connection networks, non blocking networks - Recursive network construction, comparison of non-blocking network, Switching with deflection routing - shuffle switch, tandem banyan switch.

**UNIT III QUEUES IN ATM SWITCHES****9**

Internal Queueing -Input, output and shared queueing, multiple queueing networks – combined Input, output and shared queueing - performance analysis of Queued switches.





**UNIT I INTRODUCTION****9**

Special features of Multimedia – Graphics and Image Data Representations – Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications -Need for Compression - Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

**UNIT II TEXT COMPRESSION****9**

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

**UNIT III AUDIO COMPRESSION****9**

Audio compression techniques -  $\mu$ - Law and A- Law companding. Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – Application to audio coding – MPEG audio, progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders

**UNIT IV IMAGE COMPRESSION****9**

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization – Contour based compression – Transform Coding – JPEG Standard – Sub-band coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards - JBIG, JBIG2 standards.

**UNIT V VIDEO COMPRESSION****9**

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

**TOTAL: 45 PERIODS****REFERENCES**

1. Khalid Sayood : Introduction to Data Compression, Morgan Kauffman Harcourt India, 2<sup>nd</sup> Edition, 2000.
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2<sup>nd</sup> Edition, 2001.
3. Yun Q.Shi, Huifang Sun : Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press, 2003.
4. Peter Symes : Digital Video Compression, McGraw Hill Pub., 2004.
5. Mark Nelson : Data compression, BPB Publishers, New Delhi, 1998.
6. Mark S.Drew, Ze-Nian Li : Fundamentals of Multimedia, PHI, 1<sup>st</sup> Edition, 2003.
7. Watkinson, J : Compression in Video and Audio, Focal press, London. 1995.
8. Jan Vozer : Video Compression for Multimedia, AP Profes, New York, 1995

**NE9258**

**ADVANCED ALGORITHMS**

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3 0 0 3**

**UNIT I INTRODUCTION 9**

Mathematical Background - Design and Analysis of algorithms – Time and Space Complexity - Basic concepts

**UNIT II SORTING AND ORDER STATISTICS 9**

Internal sort algorithms - Analysis - Worst-case - Average case - Sorting in Linear Time - Medians and order statistics - Augmenting Data Structures - Red Black Trees - Dynamic - Order Statistics - FFT - Algorithm - Implementation.

**UNIT III DESIGN TECHNIQUES 9**

Divide and Conquer - Dynamic Programming - Greedy method - Backtracking -- Branch & Bound – Classical examples - Analysis.

**UNIT IV GRAPH AND PARALLEL ALGORITHMS 9**

Graphs - Representation - Traversals - Topological sort - Minimum spanning tree - Shortest paths – Bi connected and strongly connected components - Parallel algorithms - Sorting - Matrix multiplication - Numerical - Graph.

**UNIT V SELECTED TOPICS 9**

NP Completeness - Approximation algorithms - Matrices - Transitive closure - Warshall's - Kronrod's algorithm - Computational Geometry

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, Introduction to Algorithms, McGraw Hill Book Company, 2002

**REFERENCES**

1. M.J. Quinn, Designing Efficient Algorithms for Parallel Computers, McGraw Hill Book Company, 1998
2. Sara Baase, "Computer Algorithms : Introduction to Design and Analysis, Addison Wesley Publishing Company, 1998
3. Donald.E.Knuth, Art of Computer Programming – Vol (1, 2, 3), Addison Wesley Professional, 1997, 1998

**UNIT I EVOLUTION OF TELECOMMUNICATION SWITCHING AND CIRCUIT 9**

Evolution of Public Switched Telecommunication Networks Strowger exchange, Crossbar exchange, Stored programme exchange Digital exchange – Basic Telecommunication equipments – Telephone handset, Hybrid circuit, Echo suppressors and cancellers, PCM coders, Modems and Relays.

**UNIT II ELECTRONIC SWITCHING 9**

Circuit Switching, Message switching, Centralized stored programme switching, Time switching, Spare switching, Combination switching – Digital switching system hardware configuration, Switching system software, Organization, Switching system call processing software, Hardware software integration.

**UNIT III TELECOMMUNICATION SIGNALLING AND TRAFFIC 9**

Channel associated signaling, Common channel signaling, SS7 signaling protocol, SS7 protocol architecture, Concept of Telecommunication traffic, Grade of service, Modeling switching systems, Blocking models and Delay systems.

**UNIT IV INTEGRATED DIGITAL NETWORKS 9**

Subscriber loop characteristics, Local access wire line and wire less PCM / TDM carrier standards transmission line codes, Digital multiplexing techniques, Synchronous, Asynchronous, Plesiocronous multiplexing techniques, SONET / SDH, Integrated Digital Network (IDN) environment – Principles of Integrated Services Digital Network (ISDN) – Cellular Mobile Communication Principles.

**UNIT V DATA NET WORKS 9**

Data transmission in PSTN – Connection oriented and Connection less protocols – packet switching – ISO-OSI architecture-Satellite based data networks – Multiple access techniques – LAN, WAN – standards – TCP / IP – Internet – Principle of ATM networks.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Viswanathan. T, "Telecommunication Switching System and Networks", Prentice Hall of India Ltd., 1994.
2. Behrouz Forouzan, "Introduction to Data Communication and Networking", McGraw-Hill, 1998.

**REFERENCES**

1. L.S.Lawton, "Integrated Digital Networks, Galgotia Publication Pvt., Ltd., New Delhi, 1996.
2. Syed R. Ali, "Digital Switching Systems", McGraw-Hill Inc., New York, 1998.

**UNIT I****9**

Introduction – Storage and networking concepts – SCSI bus architecture – Networking in front of the server – Networking behind the server – Network -attached Storage – Fibre channel internals – Layers – Data encoding – Framing protocol – class of service – flow control – Name and addressing conventions.

**UNIT II****9**

SAN topologies – Point-to Point – Arbitrated Loop – Loop Addressing-Loop Initialization-Port Login-Loop port state machine – Design considerations for Arbitrated Loop –fabrics – Fabric login – Simple Name Server – State Change Notification – Private Loop support – Fabric Zoning – Building Extended SANs.

**UNIT III****9**

Fibre Channel Products – Gigabit Interface Converters (GBICs) – host Bus Adapters – Fibre channel RAID – Fibre channel JBODs – Arbitrated Loop Hubs – hub Architecture – Unmanaged Hubs – Managed Hubs – Switching Hubs – Fabric Switches – Fibre Channel-to-SCSI Bridges – SAN software Products – Problem isolation in SANs – Isolation Techniques – Fibre channel Analyzers.

**UNIT IV****9**

Management Studies – 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****9**

Application Studies – Full-motion video – LAN free and Server free Tape Backup – server clustering – Internet Service Providers – Campus storage networks – Disaster recovery. Fiber Channel futures – Bandwidth – Fiber channel over Wide Area Networking – Coexistence within Enterprise Networks – Total SAN solutions.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Tom Clark, "Designing Storage Area Networks", Addison-Wesley Professional, 1st edition, 1999
2. Alex Goldman, "Storage Area Networks Fundamentals", Cisco Press 2002

**UNIT I INTRODUCTION TO NETWORK CONCEPTS, STANDARDS AND PROTOCOLS****9**

Introduction to Computer Networks - Networking Standards and Reference Models - Computer Network Protocols – Data Communication Fundamentals - Transmission Basics and Networking Media

<b>UNIT II</b>	<b>LOCAL AND WIDE AREA NETWORK TOPOLOGIES AND HARDWARE</b>	<b>9</b>
Physical and Logical Topologies - Network Switching - Ethernet Local Area Networks - Networking Hardware - Wide Area Networking Technologies -WAN Topologies - WANS and WAN Transmission Methods - WAN Implementation and Remote Connectivity		
<b>UNIT III</b>	<b>ENTERPRISE NETWORKING WITH WINDOWS 2000 AND NETWARE</b>	<b>9</b>
Network Operating Systems - Networking with Windows 2000 – Enterprise Networking with NetWare - NetWare Based Networking		
<b>UNIT IV</b>	<b>ENTERPRISE NETWORKING WITH UNIX</b>	<b>9</b>
Networking with UNIX – Internetworking with TCP/IP for Enterprise Applications - Networking with TCP/IP: Internet, Intranet and Extranet - Internet Applications for Enterprise		
<b>UNIT V</b>	<b>ENTERPRISE NETWORK MANAGEMENT</b>	<b>9</b>
Troubleshooting Network Problems - Maintaining and Upgrading Computer Networks - Managing Network Design and Implementation - Enterprise Network Security: Issues, Concepts, and Techniques - Introduction to Network Security - Ensuring Network Integrity and Availability		
		<b>TOTAL: 45 PERIODS</b>

**TEXT BOOK**

1. Tamara's Network+ - Guide Networks, Second edition, published by Thomson Learning, 2002.

**NE9262 OPTICAL COMMUNICATION SYSTEMS AND NETWORKING LT P C  
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<b>UNIT I</b>	<b>INTRODUCTION AND TECHNOLOGY</b>	<b>9</b>
Telecommunication networks - First _second generation of optical Networks - multiplexing techniques - Network evolution - Light propagation in optical fiber - bandwidth - chromatic dispersion -Nonlinear effects - couplers -isolators and circulators - multiplexers and filters -optical amplifiers - Transmitters - detectors - switches - wavelength converters.		
<b>UNIT II</b>	<b>MODULATION, DEMODULATION AND TRANSMISSION OF OPTICAL SIGNAL</b>	<b>9</b>
Modulation - Demodulation - transmission system engineering -Optical amplifiers - crosstalk - dispersion - fiber non linearities - wavelength stabilization - overall design considerations.		
<b>UNIT III</b>	<b>NETWORKS</b>	<b>9</b>
SONET / SDH - Computer Interconnects - Metropolitan Area Networks - Layered architecture - Broadcast networks : -Topologies for broadcast networks -Media - access control protocols - Test beds - optical layer - Node designs - network design and operation - routing and wavelength assignment.		

**UNIT IV CONTROL AND MANAGEMENT 9**  
Network Management functions - configuration Management - performance management - fault management - optical safety - service interface.

**UNIT V ACCESS NETWORKS & SWITCHING 9**  
Network architecture overview - today's access networks - future Access networks - optical access network architecture - application area - OTDM - mux and demuxing - synchronization - broadcast OTDM networks - switch bared networks - OTDM Test beds

**TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Rajiv Ramaswamy and Kumar N.Sivarajan, "Optical Networks – A Practical Persepctive", Morgan Kauffman, 2004

**REFERENCES**

1. D.W.Smith, Optical Network Technology, Chapman and Hall, London, 1995

**NE9263 DISTRIBUTED COMPUTING LT P C  
3 0 0 3**

**UNIT I INTRODUCTION 9**  
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 9**  
Interprocess 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 – I 9**  
The OS Layer - Protection - Processes and Threads - Communication and Invocation – OS Architecture - Security - Overview - Cryptographic Algorithms - Digital Signatures - Cryptography Pragmatics - Case Studies - Distributed File Systems - File Service Architecture - Sun Network File System - The Andrew File System

**UNIT IV OPERATING SYSTEM ISSUES – II 9**  
Name Services -Domain Name System - Directory and Discovery Services - Global Name Service - X.500 Directory Service - Clocks, Events and Process States - Synchronizing Physical Clocks - Logical Time And Logical Clocks - Global States - Distributed Debugging - Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.







**UNIT I INTRODUCTION 9**

Traditional protocol processing Systems – Network processing Hardware – Basic Packet Processing Algorithms and data Structures - Packet processing functions – Protocol Software – Hardware Architectures for Protocol processing – Classification and Forwarding – Switching Fabrics.

**UNIT II NETWORK PROCESSOR TECHNOLOGY 9**

Network Processors: Motivation and purpose - Complexity of Network Processor Design – Network Processor Architectures architectural variety, architectural characteristics Peripheral Chips supporting Network Processors: Storage processors, Classification Processors, Search Engines, Switch Fabrics, Traffic Managers.

**UNIT III COMMERCIAL NETWORK PROCESSORS 9**

Multi-Chip Pipeline, Augmented RISC processor, Embedded Processor plus Coprocessors, Pipeline of Homogeneous processors. Configurable Instruction set processors – Pipeline of Heterogeneous processors – Extensive and Diverse processors – Flexible RISC plus Coprocessors – Scalability issues – Design Tradeoffs and consequences.

**UNIT IV NETWORK PROCESSOR: ARCHITECTURE AND PROGRAMMING CASE STUDY 9**

Architecture: Intel Network Processor: Multiheaded Architecture Overview – Features – Embedded RISC processor - Packet Processor Hardware – Memory interfaces – System and Control Interface Components – Bus Interface. Programming Software Development Kit-IXP Instruction set – register formats – Micro Engine Programming – Intra thread and Inter-thread communication – thread synchronization – developing sample applications – control plane – ARM programming.

**UNIT V IOS TECHNOLOGIES 9**

CISCO IOS – Connectivity and scalability – high availability – IP routing – IP services – IPV6 – Mobile IP – MPLS – IP Multicast Management – QoS – Security – Switching – Layer VPN2.

**TOTAL : 45 PERIODS****REFERENCES:**

1. Douglas E.Comer “Networks Systems Design using Network Processors” Prentice Hall JaN. 2003.
2. Panos C. Lekkas, “Network Processors: Architectures, Protocols and Paradigms (Telecom Engineering)”, McGraw Hill, Professional, 2003.
3. Patrick Crowley, M a Franklin, H. Hadimoglu, PZ Onufryk, “Network Processor Design, Issues and Practices Vol-1” Morgan Kaufman, 2002.
4. Patrick Crowley, M a Franklin, H. Hadimoglu, PZ Onufryk, Network Processor Design, Issues and Practices vol.II, Morgan Kaufman, 2003.

5. Erik, J. Johnson and Aaron R. Kunze, "IXP2400/2806 Programming: The Microengine Coding Grade" Intel Press.
6. Hill Carlson, "Intel Internet Exchange Architecture & Applications a Practical Guide to Intel's network Processors" Intel press.
7. www.cisco.com

**CS9254**

**SOFT COMPUTING**

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**3 0 0 3**

**UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS**

**9**

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

**UNIT II GENETIC ALGORITHMS**

**9**

Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition

**UNIT III NEURAL NETWORKS**

**9**

Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Advances in Neural networks.

**UNIT IV FUZZY LOGIC**

**9**

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

**UNIT V NEURO-FUZZY MODELING**

**9**

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rulebase Structure Identification – Neuro-Fuzzy Control – Case studies.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.

**REFERENCES:**

1. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998
2. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 1997.

3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
4. S.N.Sivanandam · S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2007.
5. Jacek M. Zurada, "Introduction to Artificial Neural Systems", PWS Publishers, 1992.

**NW9004**

**CRYPTOGRAPHY AND NETWORK SECURITY**

**L T P C  
3 0 0 3**

**UNIT I INTRODUCTION AND NUMBER THEORY 9**

Classic Cipher Techniques – Substitution Ciphers, Mono-alphabetic Substitution and Poly-alphabetic Substitution – Transposition Ciphers. Number Theory and Finite Arithmetic, Counting in Modulus  $\rho$  Arithmetic, Congruence Arithmetic, Fermat's Theorem and Euler's Theorem- Exponentiation.

**UNIT II SINGLE AND PUBLIC KEY CIPHERS 9**

DES - 3DES – AES – RSA Algorithm, ElGamal Algorithm – Key Management using Exponential Ciphers - Diffie-Hellman.

**UNIT III MESSAGE AUTHENTICATION, DIGITAL SIGNATURES AND CERTIFICATES 9**

Security Services and Mechanisms – Message Authentication (Integrity) – MAC – Hash Functions – Digital Signature: Digital Signature Standards (FIPS 186-2), DSA (ANSI X9.30), RSA (ANSI X9.31) – RSA Certification –PKI Certificates.

**UNIT IV TRUSTED IDENTITY AND WIRELESS SECURITY 9**

Security Concerns – Password System: Fixed and One time Passwords (S/Key) RFC 2289 – Callback Systems, Challenge and Response Systems – RADIUS – Kerberos v4 & v5 – Needham Schroeder Protocol – ITU-T X.509 – Authentication: Framework, Simple, Protected, Strong – PKI Life Cycle Management - Current Wireless Technology - Wireless Security WEP Issues.

**UNIT V PROTOCOLS AND FIREWALLS 9**

SSL/TLS - SSH - IPsec – Firewall Concepts, Architecture, Packet Filtering, Proxy Services and Bastion Hosts – Electronic Mail Security – PGP, S/MIME.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. William Stallings "Cryptography and Network Security: Principles and Practice", 3rd Edition, Pearson Education, 2002.
2. William Stallings "Network Security Essentials: Applications and Standards", 2<sup>nd</sup> Edition, Pearson Education, 2000.
3. Behrouz A.Forouzan, "Cryptography and Network Security", special edition, Tata McGraw Hill, 2007.
4. Bruce Schneier, "Applied Cryptography", John Wiley & Sons, 1994.
5. Douglas R.Stinson, "Cryptography: Theory and Practice", CRC Press Series on Discrete Mathematics and its Applications, 1995.