

AFFILIATED INSTITUTIONS
ANNA UNIVERSITY, CHENNAI
REGULATIONS - 2009
CURRICULUM II TO IV SEMESTERS (FULL TIME)
M.E. NETWORK ENGINEERING

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	NE9221	<u>Network Security</u>	3	0	0	3
2	NE9222	<u>High Speed Networks</u>	3	0	0	3
3	NE9223	<u>Graph Theory</u>	3	0	0	3
4	CP9222	<u>Wireless Networks</u>	3	0	0	3
5	E2**	Elective II	3	0	0	3
6	E3**	Elective III	3	0	0	3
PRACTICAL						
7	NE9227	<u>Wireless Network Lab</u>	0	0	4	2
TOTAL			18	0	4	20

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E4**	Elective IV	3	0	0	3
2	E5**	Elective V	3	0	0	3
3	E6**	Elective VI	3	0	0	3
PRACTICAL						
4	NE9236	Project Work (Phase I)	0	0	12	6
TOTAL			9	0	12	15

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	NE9241	Project Work (Phase II)	0	0	24	12
TOTAL			0	0	24	12

Total no.of credits to be earned for the award of Degree 21+20+15+12 =68

**LIST OF ELECTIVES
M.E. NETWORK ENGINEERING**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1	CS9251	<u>Mobile Computing</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	NE9255	<u>Microwaves and Radar</u>				
21	NE9264	<u>Detection and Estimation Theory</u>				
22		Special Elective	3	0	0	3

NE9221

NETWORK SECURITY

LT P C

3 0 0 3

UNIT I CONVENTIONAL ENCRYPTION 9

Introduction, Conventional encryption model, Stenography ,Data Encryption Standard, block cipher, Encryption algorithms, confidentiality, Key distribution

UNIT II PUBLIC KEY ENCRYPTION AND HASHING 9

Principles of public key cryptosystems, RSA algorithm, Diffie- Hellman Key Exchange. Elliptic curve cryptology, message authentication and Hash functions, Hash and Mac algorithms, Digital signatures

UNIT III IP SECURITY 9

IP Security Overview, IP security Architecture, authentication Header, Security payload, security associations, Key Management

UNIT IV WEB SECURITY 9

Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature

UNIT V SYSTEM SECURITY 9

Intruders, Viruses, Worms, firewall design, Trusted systems, antivirus techniques, digital Immune systems

TOTAL: 45 PERIODS

REFERENCES

1. William Stallings,"Cryptography and Network security",2nd Edition,Prentice Hall of India,New Delhi,1999
2. Baldwin R and Rivest.R."TheRC5,RC5-CBC,TC5-CBC-PAD and RC5-CT5 Algorithms,RFC2040",October 1996.

NE9222

HIGH SPEED NETWORKS

LT P C

3 0 0 3

UNIT I HIGH SPEED NETWORKS 9

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fibre Channel – Wireless LAN's.

UNIT II CONGESTION AND TRAFFIC MANAGEMENT 9

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT III TCP AND ATM CONGESTION CONTROL 9

TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.

UNIT IV INTEGRATED AND DIFFERENTIATED SERVICES 9

Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services.

UNIT V PROTOCOLS FOR QOS SUPPORT 9

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

TOTAL: 45 PERIODS

REFERENCES

1. William Stallings, "High Speed Networks and Internet", Second Edition, Pearson Education, 2002.
2. Warland, Pravin Varaiya, "High Performance Communication Networks", Second Edition, Jean Harcourt Asia Pvt. Ltd., 2001.
3. Irvan Pepelnjk, Jim Guichard, Jeff Apcar, "MPLS and VPN Architecture", Cisco Press, Volume 1 and 2, 2003.

NE9223

GRAPH THEORY

**LT P C
3 0 0 3**

UNIT I INTRODUCTION 9

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 9

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

UNIT III COLOURING 9

Vertex Colourings and Upper Bounds - Structure of k-chromatic Graphs, Enumerative Aspects.

UNIT IV PLANAR GRAPHS, EDGES AND CYCLES 9

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.

REFERENCES

1. Clint Smith. P.E., and Daniel Collins, "3G Wireless Networks", 2nd Edition, Tata McGraw Hill, 2007.
2. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, <http://books.elsevier.com/9780123735805>., 2007.
3. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
4. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007.
5. Dharma Prakash Agrawal & Qing-An Zeng, "Introduction to Wireless and Mobile Systems", Thomson India Edition, 2nd Ed., 2007.
6. Gary. S. Rogers & John Edwards, "An Introduction to Wireless Technology", Pearson Education, 2007.
7. Sumit Kasera and Nishit Narang, " 3G Networks – Architecture, Protocols and Procedures", Tata McGraw Hill, 2007.

NE9227

WIRELESS NETWORK LAB

**LT P C
0 0 4 2**

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

TOTAL: 60 PERIODS

CS9251

MOBILE COMPUTING

**LT P C
3 0 0 3**

UNIT I 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 – ODMR.

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.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
6. Burkhardt, "Pervasive Computing", First Edition, Pearson Education, 2003.

NE9251

RELIABILITY ENGINEERING

LT 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 - ϵ -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

NEURODYNAMICS SYSTEMS

Dynamical Systems – Attractors and Stability – Non-linear Dynamical Systems- Lyapunov Stability – Neurodynamical Systems – The Cohen-Grossberg Theorem.

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

NE9254	SOFTWARE ENGINEERING METHODOLOGIES	LT P C
		3 0 0 3

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

CS9225 **WEB TECHNOLOGY** **LT P C**
3 0 0 3

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.

CP9253 HIGH SPEED SWITCHING ARCHITECTURE LT P C
3 0 0 3

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-arrangeable 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 IV PACKET SWITCHING ARCHITECTURES 9

Architectures of Internet Switches and Routers- Bufferless and buffered Crossbar switches, Multi-stage switching, Optical Packet switching; Switching fabric on a chip; Internally buffered Crossbars.

UNIT V IP SWITCHING 9

Addressing model, IP Switching types - flow driven and topology driven solutions, IP Over ATM address and next hop resolution, multicasting, Ipv6 over ATM.

TOTAL: 45 PERIODS

REFERENCES

1. Achille Pattavina, "Switching Theory: Architectures and performance in Broadband ATM networks ", John Wiley & Sons Ltd, New York. 1998
2. Elhanany M. Hamdi, "High Performance Packet Switching architectures", Springer Publications, 2007.
3. Christopher Y Metz, "Switching protocols & Architectures", McGraw - Hill Professional Publishing, NewYork.1998.
4. Rainer Handel, Manfred N Huber, Stefan Schroder, "ATM Networks - Concepts Protocols, Applications", 3rd Edition, Addison Wesley, New York. 1999.

UNIT I **9**
 Fundamentals of genetic algorithm: A brief history of evolutionary computation-biological terminology-search space -encoding, reproduction-elements of genetic algorithm-genetic modeling-comparison of GA and traditional search methods.

UNIT II **9**
 Genetic technology: steady state algorithm - fitness scaling - inversion. Genetic programming - Genetic Algorithm in problem solving

UNIT III **9**
 Genetic Algorithm in engineering and optimization-natural evolution –simulated annealing and Tabu search .Genetic Algorithm in scientific models and theoretical foundations.

UNIT IV **9**
 Implementing a Genetic Algorithm – computer implementation - low level operator and knowledge based techniques in Genetic Algorithm.

UNIT V **9**
 Applications of Genetic based machine learning-Genetic Algorithm and parallel processors, composite laminates, constraint optimization, multilevel optimization, real life problem.

TOTAL: 45 PERIODS

REFERENCES

1. Melanie Mitchell, 'An introduction to Genetic Algorithm', Prentice-Hall of India, New Delhi, Edition: 2004
2. David.E.Golberg, 'Genetic algorithms in search, optimization and machine learning', Addison-Wesley-1999
3. S.Rajasekaran and G.A Vijayalakshmi Pai, 'Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and Applications', Prentice Hall of India, New Delhi-2003.
4. Nils.J.Nilsson,'Artificial Intelligence- A new synthesis', Original edition-1999.

UNIT I **ELEMENTS OF SATELLITE COMMUNICATION** **8**
 Satellite Systems, Orbital description and Orbital mechanics of LEO, MEO and GSO, Placement of a Satellite in a GSO, Satellite – description of different Communication subsystems, Bandwidth allocation.

UNIT II **TRANSMISSION, MULTIPLEXING, MODULATION, MULTIPLE ACCESS AND CODING** **12**
 Different modulation and Multiplexing Schemes, Multiple Access Techniques – FDMA, TDMA, CDMA, and DAMA, Coding Schemes.

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, 2nd Edition, 2000.
2. David Salomon : Data Compression – The Complete Reference, Springer Verlag New York Inc., 2nd 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, 1st 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** **LT P C**
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

REFERENCES

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

NE9260

STORAGE AREA NETWORKS

**LT P C
3 0 0 3**

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 BOOK

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

UNIT II LOCAL AND WIDE AREA NETWORK TOPOLOGIES AND HARDWARE 9

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

UNIT III ENTERPRISE NETWORKING WITH WINDOWS 2000 AND NETWARE 9

Network Operating Systems - Networking with Windows 2000 – Enterprise Networking with NetWare - NetWare Based Networking

UNIT IV ENTERPRISE NETWORKING WITH UNIX 9

Networking with UNIX – Internetworking with TCP/IP for Enterprise Applications - Networking with TCP/IP: Internet, Intranet and Extranet - Internet Applications for Enterprise

UNIT V ENTERPRISE NETWORK MANAGEMENT 9

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

TOTAL: 45 PERIODS**TEXTBOOK**

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

**NE9262 OPTICAL COMMUNICATION SYSTEMS AND NETWORKING LT P C
3 0 0 3****UNIT I INTRODUCTION AND TECHNOLOGY 9**

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.

UNIT II MODULATION, DEMODULATION AND TRANSMISSION OF OPTICAL SIGNAL 9

Modulation - Demodulation - transmission system engineering -Optical amplifiers - crosstalk - dispersion - fiber non linearities - wavelength stabilization - overall design considerations.

UNIT III NETWORKS 9

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 V DISTRIBUTED TRANSACTION PROCESSING 9

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

TOTAL: 45 PERIODS

TEXT BOOK

1. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Pearson Education, 3rd Edition, 2002.

REFERENCES

1. Sape Mullender, Distributed Systems, Addison Wesley, 2nd Edition, 1993.
2. Albert Fleishman, Distributes Systems- Software Design and Implementation, Springer-Verlag, 1994
3. M.L.Liu, Distributed Computing Principles and Applications, Pearson Education, 2004.
4. Andrew S Tanenbaum , Maarten van Steen, Distibuted Systems –Principles and Pardigms, Pearson Education, 2002
5. Mughesh Singhal, Niranjan G Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill Edition, 2001

**CS9256 MULTIMEDIA SYSTEMS LT P C
3 0 0 3**

UNIT I INTRODUCTION AND QOS 9

Introduction-QOS Requirements and Constraints-Concepts-Resources- Establishment Phase-Run-Time Phase-Management Architectures.

UNIT II OPERATING SYSTEMS 9

Real-Time Processing-Scheduling-Interprocess Communication-Memory and Management-Server Architecture-Disk Management.

UNIT III FILE SYSTEMS AND NETWORKS 9

Traditional and Multimedia File Systems-Caching Policy-Batching-Piggy backing-Ethernet-Gigabit Ethernet-Token Ring-100VG AnyLAN-Fiber Distributed Data Interface (FDDI)- ATM Networks-MAN-WAN.

UNIT IV COMMUNICATION 9

Transport Subsystem-Protocol Support for QOS-Transport of Multimedia-Computer Supported Cooperative Work-Architecture-Session Management-MBone Applications.

UNIT V SYNCHRONIZATION 9

Synchronization in Multimedia Systems-Presentation-Synchronization Types-Multimedia Synchronization Methods-Case Studies-MHEG-MODE-ACME.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ralf Steinmetz and Klara Nahrstedt, "Multimedia Systems", Springer, I Edition 2004.

REFERENCES

1. Ralf Steinmetz and Klara Nahrstedt , Media Coding and Content Processing, Prentice hall, 2002.
2. Vaughan T, Multimedia, Tata McGraw Hill, 1999.
3. Mark J.B., Sandra K.M., Multimedia Applications Development using DVI technology, McGraw Hill, 1992.
4. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovacovic, D. A. Milovacovic , Multimedia Communication Systems: Techniques, Standards, and Networks, Prentice Hall, 1st Edition, 2002
5. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson, 2004.

CS9266**AGENT BASED INTELLIGENT SYSTEMS****LT P C****3 0 0 3****UNIT I INTRODUCTION 9**

Definitions - Foundations - History - Intelligent Agents-Problem Solving-Searching - Heuristics -Constraint Satisfaction Problems - Game playing

UNIT II KNOWLEDGE REPRESENTATION AND REASONING 9

Logical Agents-First order logic-First Order Inference-Unification-Chaining- Resolution Strategies-Knowledge Representation-Objects-Actions-Events

UNIT III PLANNING AGENTS 9

Planning Problem-State Space Search-Partial Order Planning-Graphs-Nondeterministic Domains-Conditional Planning-Continuous Planning-Multi-agent Planning

UNIT IV AGENTS AND UNCERTAINTY 9

Acting under uncertainty – Probability Notation-Bayes Rule and use - Bayesian Networks-Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory - Decision Network – Complex Decisions

UNIT V HIGHER LEVEL AGENTS 9

Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning-Communication-Formal Grammar-Augmented Grammars-Future of AI

TOTAL: 45 PERIODS**TEXT BOOK:**

1. Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", 2nd Edition, Prentice Hall, 2002

REFERENCES:

1. Michael Wooldridge, "An Introduction to Multi Agent System", John Wiley, 2002.
2. Patrick Henry Winston, Artificial Intelligence, 3rd Edition, AW, 1999.
3. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House, 1992.

UNIT I MODELLING OF COMMUNICATION SYSTEM 9
Model of speech and picture signals, Pseudo noise sequences, Non-linear sequences, Analog channel model, Noise and fading, Digital channel model-Gilbert model of bustry channels, HF, Troposcatter and satellite channels, Switched telephone channels, Analog and Digital communication system models, Light wave system models.

UNIT II SIMULATION OF RANDOM VARIABLES AND RANDOM PROCESS 9
Unvaried and multivaraiate models, Transformation of random variables, Bounds and approximation, Random process models-Markov AND ARMA Sequences, Sampling rate for simulation, Computer generation and testing of random numbers

UNIT III ESTIMATION OF PERFORMANCE MEASURES 9
Quality of an estimator, estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Montre carlo method and Importance sampling method, estimation of power spectral density of a process

UNIT IV COMMUNICATION NETWORKS 9
Queuing models, M/M/I and M/M/I/N queues, Little formula, Burke's theorem, M/G/I queue, Embedded Markov chain analysis of TDM systems, Polling, Random access systems

UNIT V NETWORK OF QUEUES 9
Queues in tandem, store and forward communication networks, capacity allocation, Congestion and flow chart, Routing model, Network layout and Reliability

TOTAL: 45 PERIODS

TEXT BOOK:

1. M.C.Jeruchim, Philip Balaban and K.Sam Shanmugam, "Simulation of communications systems", Plenum Press, New York, 1992

REFERENCES:

1. A.M.Law and W.David Kelton, "Simulation Modelling and analysis", Mc Graw Hill Inc., New York, 1991
2. J.F.Hayes, "Modelling and Analysis of Computer Communication networks, Plenum Press, New York, 1984
3. Jerry Banks and John S.Carson, Discrete-event system Simulation, Prentice Hall, Inc., New Jersey, 1984

UNIT I MICROWAVE SOURCES 10
Passive waveguide components, Microstrip line structure and components, Simple theory and operating characteristics of Reflex klystrons, Two cavity Klystrons, Magnetrons, and TWTS - solid state source - TEDS, IMPATTS, TRAPATT, GaAs FETs and Tunnel diode.

UNIT II RADAR PRINCIPLES 8
Introduction to Radar – Radar range equation – Receiver noise and signal to noise ratio- Radar cross section (RCS) – Radar system – Radar Antennas

UNIT III TYPES OF RADARS 10
CW and FMCW radars-Tracking radars-MTI radar -Principles of coherent MTI radars - Digital MTI, Synthetic Aperture radar, Principles of Pulsed Doppler Radar, Low-, High-, and medium-PRF Mode.

UNIT IV RADAR SIGNAL PROCESSING 9
Radar requirements –Matched filters- Radar ambiguity function – Optimum waveforms for detection in clutter – Classes of waveforms – Digital representation of signals -Pulse compression

UNIT V TRACKING RADAR 8
Tracking with radar – Monopulse Tracking – conical scan and sequential lobing – limitations to tracking Accuracy- Kalman Tracker -Fundamentals of Airborne radar

TOTAL : 45 PERIODS

REFERENCES:

1. Fred E.Nathanson “ Radar design Principles “ Signal processing and the environment, Prentice Hall, 2004
2. Y. Liao, Microwave Devices and Circuits, Prentice Hall, 1980.
3. M.I. Skolnik, Introduction to Radar System (Second Edition) McGraw Hill, 1980.
4. M.I. Skolnik, Radar Handbook (Second Edition) McGraw Hill, 1990.
5. Guy V. Morris, Linda L. Harkness, Airborne Pulsed Doppler radar, Second Edition, Artech House Publishers, 1996.
6. Blackman S.S., “Multiple target tracking with radar applications” Artech House 1986.

**NE9264 DETECTION AND ESTIMATION THEORY LT P C
3 0 0 3**

UNIT I REVIEW OF PROBABILITY AND STOCHASTIC PROCESS 9
Conditional Probability, Bayes' Theorem , Random Variables, Conditional Distributions and Densities, moments and distribution of random variables., Stationary Processes Cyclostationary Processes Averages and Ergodicity Autocorrelation Function Power Spectral Density Discrete-Time Stochastic Processes Spatial Stochastic Processes Random Signals, Relationship of Power Spectral Density and Autocorrelation Function.

UNIT II SINGLE AND MULTIPLE SAMPLE DETECTION 9
Hypothesis Testing and the MAP Criterion, Bayes Criterion , Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection, The Optimum Digital Detector in Additive Gaussian Noise , Performance of Binary Receivers in AWGN

UNIT III FUNDAMENTALS OF ESTIMATION THEORY 9
Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory, Types of Estimation Problems, Properties of Estimators, Bayes Estimation, Minimax Estimation, Maximum-Likelihood Estimation, Comparison of Estimators of Parameters

UNIT IV WIENER AND KALMAN FILTERS 9
Orthogonality Principle, Autoregressive Techniques, Discrete Wiener Filter, Continuous Wiener Filter, Generalization of Discrete and Continuous Filter Representations , Linear Least-Squares Methods, Minimum-Variance Weighted Least-Squares Methods,

Minimum-Variance Least-Squares or Kalman Algorithm, Kalman Algorithm Computational Considerations, Kalman Algorithm for Signal Estimation, Continuous Kalman Filter, Extended Kalman Filter

UNIT V APPLICATIONS

9

Detector Structures in Non-Gaussian Noise , Examples of Noise Models, Receiver Structures, and Error-Rate Performance, Estimation of Non-Gaussian Noise Parameters Fading Multipath Channel Models, Receiver Structures with Known Channel Parameters, Receiver Structures without Knowledge of Phase, Receiver Structures without Knowledge of Amplitude or Phase, Receiver Structures and Performance with No Channel Knowledge.

TOTAL : 45 PERIODS

REFERENCES:

1. Thomas Schonhoff," Detection and Estimation Theory", Prentice Hall, New Jersey, 2007
2. Steven M. Kay," Fundamentals of Statistical Processing, Volume I: Estimation Theory", Prentice Hall Signal Processing Series, Prentice Hall, PTR, New Jersey, 1993.
3. Harry L. Van Trees, Detection, Estimation, and Modulation Theory, Part I John Wiley and Sons, New York, 2001.