KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

M.E. DEGREE IN COMPUTER AND COMMUNICATION ENGINEERING (FULL TIME)
CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT16	Applied Mathematics for Communication Engineers	3	1	0	4	40	60	100
14CNT11	Data Structures and Algorithms	3	1	0	4	40	60	100
14MIT13	Advanced Database Technologies	3	0	0	3	40	60	100
14CNT12	Advanced Operating Systems	3	0	0	3	40	60	100
14CNT13	Modern Digital Communication Techniques	3	1	0	4	40	60	100
14CNT14	Multimedia Compression Techniques	3	0	0	3	40	60	100
	PRACTICAL							
14CNL11	Data Communication Laboratory	0	0	3	1	100	0	100
14CNL12	Data Structures and Operating Systems Laboratory	0	0	3	1	100	0	100
				Total	**23**			

CA - Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMPUTER AND COMMUNICATION ENGINEERING (FULL TIME)
CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14MIT22	Information Theory and Coding	3	0	0	3	40	60	100
14COT21	Wireless Communication Networks	3	0	0	3	40	60	100
14CNT21	Communication Network Security	3	1	0	4	40	60	100
14CNT22	High Speed Networks	3	0	0	3	40	60	100
	Elective – I (Professional)	3	0	0	3	40	60	100
	Elective – II (Professional)	3	0	0	3	40	60	100
	PRACTICAL							
14COL22	Wireless Communication and Network Systems Laboratory	0	0	3	1	100	0	100
14CNL21	Network Security Laboratory	0	0	3	1	100	0	100
				Total	**21**			

CA – Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMPUTER AND COMMUNICATION ENGINEERING (FULL TIME)
CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective – III (Professional)	3	0	0	3	40	60	100
	Elective – IV (Professional)	3	0	0	3	40	60	100
	Elective – V (Open)	3	0	0	3	40	60	100
	PRACTICAL							
14CNP31	Project Work - Phase I	0	0	12	6	50	50	100
				Total	**15**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER - IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
14CNP41	Project Work - Phase II	0	0	24	12	100	100	200
				Total	**12**			

CA- Continuous Assessment, ESE – End Semester Examination

Total Credits: 71

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M.E. DEGREE IN COMPUTER AND COMMUNICATION ENGINEERING (PART TIME) CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – I

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14AMT16	Applied Mathematics for Communication Engineers	3	1	0	4	40	60	100
14CNT11	Data Structures and Algorithms	3	1	0	4	40	60	100
14MIT13	Advanced Database Technologies	3	0	0	3	40	60	100
	PRACTICAL							
14CNL12	Data Structures and Operating Systems Laboratory	0	0	3	1	100	0	100
				Total	**12**			

CA - Continuous Assessment, ESE – End Semester

SEMESTER – II

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14MIT22	Information Theory and Coding	3	0	0	3	40	60	100
14COT21	Wireless Communication Networks	3	0	0	3	40	60	100
	Elective – I (Professional)	3	0	0	3	40	60	100
	PRACTICAL							
14COL22	Wireless Communication and Network Systems Laboratory	0	0	3	1	100	0	100
				Total	**10**			

CA – Continuous Assessment, ESE – End Semester Examination

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M.E. DEGREE IN COMPUTER AND COMMUNICATION ENGINEERING (PART TIME)
CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – III

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14CNT12	Advanced Operating Systems	3	0	0	3	40	60	100
14CNT13	Modern Digital Communication Techniques	3	1	0	4	40	60	100
14CNT14	Multimedia Compression Techniques	3	0	0	3	40	60	100
	PRACTICAL							
14CNL11	Data Communication Laboratory	0	0	3	1	100	0	100
				Total	**11**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER – IV

Course Code	Course Title	Hours/ Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
14CNT21	Communication Network Security	3	1	0	4	40	60	100
14CNT22	High Speed Networks	3	0	0	3	40	60	100
	Elective – II (Professional)	3	0	0	3	40	60	100
	PRACTICAL							
14CNL21	Network Security Laboratory	0	0	3	1	100	0	100
				Total	**11**			

CA – Continuous Assessment, ESE – End Semester Examination

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638 052
(Autonomous)

M.E. DEGREE IN COMPUTER AND COMMUNICATION ENGINEERING (PART TIME) CURRICULUM

(For the candidates admitted from academic year 2014 – 15 onwards)

SEMESTER – V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	THEORY							
	Elective – III (Professional)	3	0	0	3	40	60	100
	Elective - IV (Professional)	3	0	0	3	40	60	100
	Elective - V (Open)	3	0	0	3	40	60	100
	PRACTICAL							
14CNP31	Project Work - Phase I	0	0	12	6	50	50	100
				Total	**15**			

CA – Continuous Assessment, ESE – End Semester Examination

SEMESTER - VI

Course Code	Course Title	Hours / Week			Credit	Maximum Marks		
		L	T	P		CA	ESE	Total
	PRACTICAL							
14CNP41	Project Work - Phase II	0	0	24	12	100	100	200
				Total	**12**			

CA- Continuous Assessment, ESE – End Semester Examination

Total Credits: 71

LIST OF ELECTIVES					
Course Code	**Course Title**	**Hours/Week**			**Credit**
		L	**P**	**T**	
14CNE01	Advanced Network Design and Performance Tuning	3	0	0	3
14CNE02	Wireless Sensor Networks	3	0	0	3
14CNE03	Java Technologies	3	0	0	3
14CNE04	Simulation of Communication Networks	3	0	0	3
14CNE05	Network Routing Algorithms	3	0	0	3
14CNE06	Adhoc Networks	3	0	0	3
14MSE05	Cloud Computing	3	0	0	3
14MSE17	Soft Computing	3	0	0	3
14MST14	Mobile and Pervasive Computing	3	0	0	3
14CNE07	Software Quality Assurance and Testing	3	0	0	3
14MSE04	Business Intelligence	3	0	0	3
14MSE06	Compiler Design Techniques	3	0	0	3
14MSE02	Big Data Analytics	3	0	0	3
14COT14	Optical Networks	3	0	0	3
14COT11	Statistical Signal Processing	3	1	0	4
14COT15	Transform Techniques	3	1	0	4
14COE01	CDMA Engineering	3	0	0	3
14COE10	Multicarrier Communication	3	0	0	3
14COE11	Spread Spectrum Communication	3	0	0	3
14COE05	Digital Image Processing and Multi Resolution Analysis	3	0	0	3

* - Open Elective

14AMT16 APPLIED MATHEMATICS FOR COMMUNICATION ENGINEERS

(Common to Communication Systems & Computer and Communication Engineering)

3 1 0 4

UNIT – I **9**

Vector Spaces: Definition – Subspaces – Span – Linear dependence and independence – Basis and dimension – Row space, Column space and Null Space – Rank and nullity.

UNIT – II **9**

Inner Product Spaces: Inner products – Angle and Orthogonality in inner product spaces – Orthonormal Bases – Gram-Schmidt Process – QR-Decomposition – Orthogonal Projection – Least square technique – Orthogonal matrices.

UNIT – III **9**

Linear Programming: Formulation – Graphical solution – Simplex method – Two phase method - Transportation Model – Initial Basic Feasible Solution – North west corner rule – Vogel's approximation method – Optimum solution by MODI method – Assignment problems – Hungarian method

UNIT – IV **9**

Stochastic Processes: Introduction – Classification of Stochastic Processes – Markov Chain: Introduction -Transition Probability Matrices – Chapman Kolmogorov equations - Classification of States – Continuous Time Markov Chains – Poisson Process - Birth and Death Processes.

UNIT - V **9**

Queuing Theory: Markovian queues – Single and Multi-server Models – Little's formula – Machine Interference Model - Non- Markovian Queues – Pollaczek Khintchine Formula.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS:

1. Howard Anton, Chris Rorres, "Elementary Linear Algebra" John Wiley and Sons, 2010.
2. David C Lay, "Linear Algebra and Its Applications", Pearson Education, 2009.
3. Taha, H.A., "Operations Research, An introduction", Seventh Edition, Pearson Education Editions, Asia, New Delhi, 2002.
4. Roy D.Yates and David J Goodman, "Probability and Stochastic Processes – A friendly Introduction for Electrical and Computer Engineers", John Wiley and Sons, 2005.
5. Donald Gross and Carl M. Harris, "Fundamentals of Queuing theory", Second Edition, John Wiley and Sons, New York, 1985.

Course Outcomes:

On completion of the course the students will be able to

- handle problems in linear algebra
- solve linear programming problems
- process information using random process
- use queuing theory in communication

14CNT11 DATA STRUCTURES AND ALGORITHMS

3 1 0 4

UNIT – I **9**

Introduction: Notion of algorithm -fundamentals of analysis framework – asymptotic notations and basic efficiency classes **–** NP-Hard and NP Completeness. Mathematical analysis: Recursion-Forward versus Backward-Recursion tree method-Master method-non-recursive and recursive algorithms.

Algorithmic Techniques: Brute force: Selection and Bubble sort, Sequential search - Divide and Conquer: Merge sort, Quick sort– Decrease and conquer: Insertion sort, Depth First Search and Breadth First Search.

UNIT – II **9**

Trees: Binary Search trees and Operations-Transform and Conquer - AVL Trees and balancing operations-Heaps- R B Trees and B – Trees – definition – properties-operations.

Hashing: Direct address tables and hash tables, hash functions-Separate Chaining-Linear Probing-Open Addressing-extendable Hashing

UNIT – III **9**

Optimization Algorithms: Optimization Problems-Graph Search Algorithms-Generic Search-Breadth-First Search- Dijkstra's Shortest-Weighted-Path -Depth-First Search-Recursive Depth-First Search-Linear Ordering of a Partial Order- Network Flows and Linear Programming-Hill Climbing-Primal Dual Hill Climbing- Steepest Ascent Hill Climbing.

UNIT – IV **9**

Dynamic Programming: Rod Cutting- Matrix-chain multiplication-Longest Common Subsequences- Warshall's algorithm- All pairs shortest path problem - Traveling salesman problem-Optimal Binary Search Tree.

Greedy Algorithms: General method, applications-Job sequencing with deadlines - Knapsack problem- Minimum cost spanning trees, Single source shortest path problem-Huffman Codes.

UNIT – V **9**

Linear programming and String Matching algorithms: Standard and slack forms-Formulating problems as linear programs-The simplex algorithm-Polynomials and FFT.

String Matching: Naive string matching-Knuth-morris –pratt-Rabin-Karp algorithm-Boyer-Moore algorithm.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS:

1. Thomas H. Coreman, Charles E.Leiserson, Ronald L.Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2010.
2. Jeff.Edmonds, "How to think about algorithms", Cambridge University, 2008
3. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2007.
4. E. Horowitz, S.Sahni and S.Rajasekaran, "Computer Algorithms/C++", Second Edition, University Press, 2007.
5. Alfred V.Aho, Jeffrey D.Ullman, John E.Hopcroft, "Data Structures and Algorithms", Pearson Education, New Delhi, 2002.

Course Outcomes:

On completion of the course the students will be able to

- analyze the algorithms and determine their time efficiency class.
- explore various algorithmic techniques.
- design and implement optimization algorithms in specific applications.
- analyze various linear programming and string matching algorithms.problems

14MIT13 ADVANCED DATABASE TECHNOLOGIES

(Common to Information Technology & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Physical database design and tuning: Introduction to database systems: File system versus a DBMS-Advantages of a DBMS-Describing and storing data in a DBMS-Structure of a DBMS- Tree based indexing-B+tree-Hash based indexing- Functional dependencies-Normal forms(1NF-5NF)-Introduction to physical database design-Guidelines for index selection-Examples-Clustering and indexing-indexes on multiple-attribute search keys-Enable index only plans-Data base tuning - overview-conceptual schema-queries and views-Impact of concurrency- DBMS bench marking

UNIT – II **9**

Parallel and distributed databases: Parallel database: Architecture- Parallel query evaluation-Parallelizing Individual operation- Parallel Query optimization-Distributed Database: Types – Architectures-Data Storage – Distributed query processing-Updating distributed data- Distributed Transactions – Distributed Concurrency Control – Distributed recovery

UNIT – III **9**

Object database systems and spatial data management: Object database systems: Structured Data types- Operations on Structured Data - Encapsulation and ADTs- Inheritance – Objects, OIDs, and Reference types- Database design for an ORDBMS- Spatial data management: Spatial Data Types-Spatial indexes-Grid files-R trees-Issues

UNIT – IV **9**

Enhanced data models for advanced applications : Active database concepts and triggers-Temporal database concepts-Deductive database: Overview- Datalog notation- Clausal form and Horn clauses-Interpretation of rules-Datalog programs- Evaluation of non recursive datalog queries

UNIT – V **9**

Emerging technologies: Mobile Databases: Mobile computing architecture- Issues- Multimedia databases: Type of multimedia data - Issues –Research problems-XML Databases: XML Hierarchical data model- XML DTD,schema- XML documents and databases- Querying

TOTAL : 45

REFERENCE BOOKS:

1. Raghu Ramakrishnan, Johannes, “Database Management Systems”, McGraw Hill, Third Edition 2004.
2. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Fifth Edition, Pearson Education/Addison Wesley, 2007.
3. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.
4. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Fifth Edition, McGraw Hill, 2006.
5. C.J.Date, A.Kannan and S.Swamynathan, ”An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

Course Outcomes:

On completion of the course the students will be able to

- select the appropriate high performance database like parallel and distributed database
- model and represent the real world data using object oriented database
- represent the data using XML database for better interoperability

14CNT12 ADVANCED OPERATING SYSTEMS

3 0 0 3

UNIT – I **9**

Introduction: Overview - Functions of an Operating System – Design Approaches – Types of Advanced Operating System - Synchronization Mechanisms – Concept of a Process- Concurrent Processes – The Critical Section Problem- Other Synchronization Problems – Language Mechanisms for Synchronization – Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries – Models of Deadlock - Resources- System State – Necessary and Sufficient conditions for a Deadlock – Systems with Single-Unit Requests-Consumable Resources-Reusable Resources.

UNIT – II **9**

Distributed Operating Systems: Introduction – Issues – Communication Primitives – Inherent Limitations - Lamport's Logical Clock - Vector Clock - Causal Ordering – Global State – Cuts, Termination Detection- Distributed Mutual Exclusion – Non-Token Based Algorithms – Lamport's Algorithm - Token-Based Algorithms – Suzuki- Kasami's Broadcast Algorithm – Distributed Deadlock Detection– Issues – Centralized Deadlock-Detection Algorithms - Distributed Deadlock-Detection Algorithms - Agreement Protocols – Classification - Solutions –Applications.

UNIT – III **9**

Distributed Resource Management: Distributed File systems – Architecture – Mechanisms – Design Issues – Distributed Shared Memory – Architecture – Algorithm – Protocols

UNIT – IV **9**

Failure Recovery and Fault Tolerance : Basic Concepts-Classification of Failures – Basic Approaches to Recovery- Recovery in Concurrent System- Synchronous and Asynchronous Check pointing and Recovery-Check pointing in Distributed Database Systems- Fault Tolerance- Issues - Two-phase and Non blocking Commit Protocols-Voting Protocols- Dynamic Voting Protocols

UNIT – V **9**

Multiprocessor and Database Operating Systems: Structures – Design Issues – Threads – Process Synchronization - Processor Scheduling – Memory Management – Database Operating Systems: Introduction – Concurrency Control : Database systems-Distributed Database Systems – The problem of concurrency control- Concurrency Control Algorithms: Lock based algorithms – Time stamp based algorithms

TOTAL : 45

REFERENCE BOOKS:

1. Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill, 2001
2. Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", Ninth Edition, Addison Wesley Publishing Co., 2013.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.

Course Outcomes:

On completion of the course the students will be able to

- identify and explore the aspects of concurrency in operating systems
- compare and contrast the various design issues of distributed operating systems
- examine the failure delivery and fault tolerance of distributed operating systems
- analyze the multiprocessor design and concurrency control in distributed database systems

14CNT13 MODERN DIGITAL COMMUNICATION TECHNIQUES

3 1 0 4

UNIT – I **9**

Introduction: Sources and Signals- Channels for Digital Communications- Fundamental Limits on Performance-Discrete Memory less Channel-Channel Coding Theorem- Detection and Estimation - Model of Digital Communication System- Probability of Error- Correlation and Matched Filter Receivers- Maximum Likelihood Estimation-Linear Prediction - Linear Predictive Vocoders, Adaptive Filters - Sampling Theorem - Linear and Adaptive Equalizers

UNIT – II **9**

Digital Modulation : Digital modulation formats - Coherent Binary modulation techniques - Coherent Quadrature modulation techniques - Non-coherent Binary modulation techniques - Comparison of Binary- Quaternary and M-ary modulation techniques - M-ary modulation techniques – Power Spectra - Bandwidth Efficiency-Synchronization

UNIT – III **9**

Block Coded Digital Communication : Rationale for coding and Types of codes - Linear blocks codes - Cyclic codes - Applications – Coding for White Gaussian Noise Channels-Coding for compound-error channels- Block codes for Error Control in data storage and Trellis-coded Modulation for efficient utilization of bandwidth and power

UNIT – IV **9**

Convolutional Coded Digital Communication: Convolutional codes - Maximum-Likelihood decoding of convolutional codes - Distance properties of convolutional codes - Sequential decoding of convolutional codes - Trellis Codes

UNIT – V **9**

Spread Spectrum Techniques: Generation of Pseudo-noise Sequences – A Notion of Spread Spectrum - Broadband and Narrowband Interferences - Partial-time and Partial-band Jamming - Direct-sequence Spread Coherent BPSK - Error rate performance of the coder - Signal-space Dimensionality and Processing Gain – Frequency-Hop Spread Spectrum – Time-Hopping Spread Spectrum – Applications

Lecture: 45, Tutorial: 15, TOTAL : 60

REFERENCE BOOKS:

1. Simon Haykins, 'Digital communications', 8th Edition, John Wiley and sons, 1988.
2. John G. Proakis, 'Digital Communications', 4th Edition, McGraw-Hill, New York, 2001.
3. Wayne Tomasi, 'Advanced electronic communication systems', 6th Edition, Pearson Education Asia, 2003.
4. B.P.Lathi, 'Modern digital and analog communication systems', 3rd Edition, Oxford University Press, 1998.

Course Outcomes:

On completion of the course the students will be able to

- analyze digital modulation techniques by using signal processing tools
- identify different modulation schemes, compare and judge the applicability of these techniques in different situations
- analyze the need for and role of coding techniques for communication efficiency
- apply suitable modulation schemes and coding for various applications
- provide security to demanding engineering problem with advanced mathematical models

14CNT14 MULTIMEDIA COMPRESSION TECHNIQUES

(Common to Computer and Communication Engineering & Communication Systems)

3 0 0 3

UNIT – I **9**

Introduction : Special features of Multimedia – Graphics and Image Data Representations – Popular File formats - Fundamental Concepts in Video - Digital Audio – Storage requirements for multimedia applications -Need for Compression - Lossy & Lossless compression techniques– Overview of Source Models - Source coding - Scalar and Vector quantization

UNIT – II **9**

Text Compression: Compression techniques: Shannon- Fano coding -Huffman coding – Adaptive Huffman Coding – Arithmetic coding – Dictionary techniques : LZW algorithm.

UNIT– III **9**

Audio Compression: Audio compression techniques - μ- Law and A-Law companding-Frequency domain and filtering – Differential Encoding –DPCM- ADPCM – DM – Optimal Predictors and Optimal Quantization -Application to speech coding: G.722 – Application to audio coding : MPEG audio, Silence compression- Speech compression techniques : Formants and CELP Vocoders

UNIT– IV **9**

Image Compression : Transform Coding: JPEG Standard – Sub band coding algorithms - Design of Filter banks – Implementation using filters- Wavelet based compression: EZW- SPIHT coders – JPEG 2000 standards- JBIG- JBIG2 standards

UNIT – V **9**

Video Compression : Video compression Based on Motion Compensation – Search for Motion Vectors - H.261 - MPEG Video Coding I: MPEG – 1 and 2 – MPEG Video Coding II: MPEG – 4: Object Based Visual Coding –Synthetic Object Coding –Object types-Profiles and Levels – MPEG 7.

TOTAL : 45

REFERENCE BOOKS:

1. Morgan Kauffman, Khalid Sayood, “Introduction to Data Compression”, 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 , 2004
5. Mark Nelson , “ Data compression”, BPB Publishers, New Delhi,2000
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

Course Outcomes:

On completion of the course the students will be able to

- perform text and audio compression
- acquire the knowledge of various compression techniques in image and video
- apply the above knowledge and skills to compress various types of media

14CNL11 DATA COMMUNICATION LABORATORY

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES

1. Study of Network simulators (NS2 & GloMoSim)
2. Implementation of Various Topologies.
3. Implementation of Sliding Window Protocol.
4. Implementation of OSPF Routing Algorithm
5. Implementation of Link State Routing Algorithm
6. Simulation of Congestion Control Algorithms.
7. Performance analysis of TCP
8. Performance analysis of UDP
9. Implementation of ARP and RARP Protocol.
10. Design of Local Area Network.

TOTAL : 45

REFERENCES / MANUALS/SOFTWARE:

- C,C++, NS2, GloMoSim

Course Outcomes:

On completion of the course the students will be able to

- gain knowledge about various Network Simulators and to simulate various topologies
- design basic routing algorithms used for wired environment
- analyze the performance of various protocols used for data communication
- implement Local Area Network using various topologies

14CNL12 DATASTRUCTURES AND OPERATING SYSTEMS LABORATORY

0 0 3 1

LIST OF EXPERIMENTS /EXERCISES

1. Implement Tower of Hanoi for n number of disks.
2. Implement insertion and deletion in AVL trees and R-B Tree.
3. Implement any one of the collision hashing methods.
4. Implement Prim's algorithm using priority queues to find MST of an undirected graph.
5. Implement any one of the string matching algorithms.
6. Implement the Quick Sort and Heap Sort
7. Implement concurrent echo client-server application
8. Implement concurrent day - time client - server application
9. Implement shared memory for accessing counter using semaphore
10. Implement a real-time program for implementing an alarm clock
11. Implement Transactions and Concurrency in Database operating systems for any real time applications.

TOTAL : 45

REFERENCES / MANUALS/SOFTWARE:

- C/C++ in Unix/Linux C Programming Environment, Java

Course Outcomes:

On completion of the course the students will be able to

- identify and implement appropriate data structure for a given problem
- design concurrency algorithms for client-server applications
- implement communication among threads
- design small real time applications in OS

14MIT22 INFORMATION THEORY AND CODING

(Common to Information Technology & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Source Coding: Introduction to Information theory - Uncertainty and Information - Average Mutual Information and Entropy - Source Coding Theorem - Shannon-fano coding - Huffman Coding - Arithmetic Coding - Lempel-Ziv algorithm - Run-length Encoding and Rate Distortion Function.

UNIT – II **9**

Channel capacity and coding: Channel Models - Channel Capacity - Channel Coding - Information Capacity Theorem - Random Selection of Codes - Error control coding: Linear Block Codes and their properties - Decoding of Linear Block Code - Perfect codes - Hamming codes - Optimal Linear Codes and MDS codes.

UNIT – III **9**

Cyclic codes: Polynomials - Division algorithm for Polynomials - A method for generating cyclic codes, Matrix description of cyclic codes, Burst error correction - Fire codes - Golay codes - CRC codes - Circuit implementation of cyclic codes - BCH codes: Minimal polynomials - Generator polynomial for BCH codes - Decoding of BCH codes - Reed-Solomon codes and Nested codes.

UNIT – IV **9**

Convolutional codes: Tree codes and Trellis codes - Polynomial description of convolutional codes - Distance notions for convolutional codes - Generation function - Matrix description of convolutional codes - Viterbi decoding of convolutional codes - Distance bounds for convolutional codes - Turbo codes and Turbo Decoding.

UNIT – V **9**

Trellis Coded Modulation: Concept of Coded Modulation - Mapping by set partitioning - Unger beck's TCM design rules - TCM decoder - Performance evaluation for Additive White Gaussian Noise (AWGN) Channel - TCM for fading channels.

TOTAL : 45

REFERENCE BOOKS:

1. Ranjan Bose, "Information theory, coding and cryptography", Tata McGraw Hill, 2002.
2. Viterbi, "Information theory and coding", McGraw Hill, 1982.
3. John G. Proakis, "Digital Communications", 2nd Edition, McGraw Hill, 1989.

Course Outcomes:

On completion of the course the students will be able to

- apply encoding and decoding of digital data streams
- acquire a complete understanding of error–control coding
- acquire a detailed knowledge of compression and decompression techniques

14COT21 WIRELESS COMMUNICATION NETWORKS

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Wireless Networks

UNIT – I **9**

Characteristics of Wireless Medium: Introduction, Radio propagation mechanism, path loss Modeling and Signal Coverage, Effects of Multipath and Doppler, Considerations in the design of Wireless Radio communication.

UNIT – II **9**

Medium Access Alternatives: Fixed assignment for voice oriented networks, Random Access for data oriented networks, Integration of voice and data traffic.

UNIT – III **9**

Wireless Network Fundamentals: Principle of Wireless network operation: Wireless network topologies, Cellular topology, Cell fundamentals, Signal to interference ratio calculation and Capacity expansion techniques, Network planning for CDMA system, Mobility management, Radio resources and power management, security in wireless networks

UNIT – IV **9**

Wireless WANs: Communication in the infrastructure, GSM, CDMA, IMT 2000, GPRS and High data rates, Short message service in GSM, Mobile Application Protocols.

UNIT – V **9**

Wireless LANs and Adhoc Networks: Introduction to wireless LANs - IEEE 802.11 WLANs - Physical Layer- MAC sublayer- MAC Management Sublayer- HIPERLAN1 - HIPERLAN-2, IEEE 802.15 WPAN – Home RF, Bluetooth, Zigbee, Wireless Geolocation system 4G features and challenges, 4G technologies

Total : 45

REFERENCE BOOKS:

1. Kaveh Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless Networks", Prentice Hall of India, 2006.
2. Leon Garcia, Widjaja, “Communication Networks”, Tata McGraw Hill, New Delhi 2000
3. William Stallings, "Wireless Communications and networks" Pearson / Prentice Hall of India, 2nd Ed., 2007
4. Rappaport T.S, “Wireless Communications: Principles and Practice”, Second Edition, Pearson Education/ Prentice Hall of India, New Delhi, 2003
5. Lee William C.Y, “Wireless and Cellular Telecommunications:, Third Edition, Tata McGraw-Hill, New Delhi, 2005.

Course Outcomes:

On completion of the course the students will be able to

- apply the concepts of wireless MANs, LANs and PANs in wireless communication networks
- provide technological solution towards Physical and MAC Layer problems of Cellular, PAN and WLAN Networks

14CNT21 COMMUNICATION NETWORK SECURITY

3 1 0 4

UNIT – I **9**

Introduction and Number Theory : Introduction : Services, Mechanisms and attacks- OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography)- Finite fields and number theory: Groups, Rings, Fields-Modular arithmetic-Euclid‟s algorithm-Finite fields- Polynomial Arithmetic – Prime numbers-Fermat's and Euler‟s theorem-Testing for primality -The Chinese Remainder theorem- Discrete Logarithms.

UNIT – II **9**

Block Ciphers and Public Key Cryptography: Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm- Public key cryptography**:** Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT – III **9**

Hash Functions and Digital Signatures : Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

UNIT – IV **9**

Security Practice and System Security: Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

UNIT – V **9**

E-Mail, IP and Web Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME- IPSecurity**:** Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding)- Web Security**:** SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS:

1. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013. (UNIT I, II, III, IV).
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002. (UNIT V).
3. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
4. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
5. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.

Course Outcomes:

On completion of the course the students will be able to

- compare various cryptographic techniques
- design Secure applications
- identify the flaws in system and web security

14CNT22 HIGH SPEED NETWORKS

(Common to Computer and Communication Engineering & Computer Science and Engineering)

3 0 0 3

UNIT – I **9**

High Speed Networks : Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL- High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fibre Channel – Wireless LANs: applications, requirements – Architecture of 802.11

UNIT – II **9**

Congestion and Traffic Management: Queuing Analysis- Queuing Models – Single Server Queues – Multi server queues-Effects of congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

UNIT – III **9**

TCP and ATM Congestion Control : TCP Flow control – TCP Congestion Control – Retransmission Timer Management – Exponential RTO backoff – KARNs 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 **9**

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

UNIT – V **9**

Protocols for QoS Support : RSVP – Goals and Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP

TOTAL : 45

REFERENCE BOOKS:

1. Stallings William, “High Speed Networks and Internet”, Second Edition, Pearson Education, New Delhi, 2002.
2. Walrand and Pravin Varaiya, “High Performance Communication Networks”, Second Edition, Jean Harcourt Asia Pvt. Ltd., 2001.
3. Pepelnjak Irvan, Guichard Jim and Apcar Jeff, “MPLS and VPN Architecture”, Cisco Press, Volume 1 and 2, 2003
4. http://pages.cpsc.ucalgary.ca/~carey/CPSC641/archive/Sept2005/

Course Outcomes:

On completion of the course the students will be able to

- develop an in-depth understanding, in terms of architecture, protocols and applications, of major high-speed networking technologies
- solve numerical or analytical problems pertaining to the high-speed networking technologies
- design and configure a network to support a specified set of applications
- develop necessary background to manage projects involving any of the high-speed networking technologies

14COL22 WIRELESS COMMUNICATION AND NETWORK SYSTEMS LABORATORY

(Common to Communication Systems & Computer and Communication Engineering)

0 0 3 1

LIST OF EXPERIMENTS:

1. Signal power levels, Data Rates, Routing Protocols, Antenna Weighting, Link Scheduling, and Weak Performance of Network Components for Sensor Networks –IEEE 802.15.4 (Zigbee).
2. Modeling of GSM Cellular Networks.
3. Satellite Modeling and Ground Station design Using Emulator.
4. Propagation Model analysis for Indoor, Urban, Suburban, and Forested terrain effects.
5. Study of ZIGBEE / Bluetooth.
6. Simulation and performance evaluation of entity mobility models using NS2
7. Simulation and performance evaluation of Ad-hoc routing protocols using NS2
8. Simulation and performance evaluation of Wireless MAC protocols using NS2
9. Simulation and performance evaluation of Wi –Fi LAN
10. Simulation and performance evaluation of Wi max

TOTAL : 45

REFERENCES / MANUALS / SOFTWARE:

- NS2
- EXATA Emulator

Course Outcomes:

On completion of the course the students will be able to

- model radio signal propagation issues and analyze their impact on communication system performance
- simulate various routing protocols in Ad-hoc Mode
- emulate Video streaming under wireless test bed WLAN, Wired and PAN

14CNL21 NETWORK SECURITY LABORATORY

0 0 3 1

LIST OF EXPERIMENTS

1. Implementation of Ceaser cipher with Brute force attack, one time pad, poly alphabetic cipher
2. Implémentation of Permutation and Transposition Techniques
3. Implémentation of Single round DES upto S box design
4. Implémentation of RSA
5. Implementation of Diffie Hellman key exchange
6. Implementation of Random number generator
7. Implementation of Fermat's theorem, Euler's theorem and Euclidian algorithm
8. Implementation of Extended Euclidian algorithm and CRT
9. Implementation of Miller Rabin Primality test and identifying the weakness of the test
10. Implementation of Hashing technique and Birthday attack
11. Implementation of Elliptic curve cryptography
12. Implementation of signature using DSS and RSA approach
13. Implementation of a simple firewall
14. Study of Kerberos, SSL and PGP

TOTAL : 45

REFERENCES / MANUALS/SOFTWARE:

- Linux and C

Course Outcomes:

On completion of the course the students will be able to

- implement network security services and techniques
- analyze various types of attacks in Network and overcome those attacks
- implement security algorithms using sender and receiver approach

14CNE01 ADVANCED NETWORK DESIGN AND PERFORMANCE TUNING

3 0 0 3

UNIT – I **9**

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 – non blocking networks -construction and comparison of non-blocking network.

UNIT – II **9**

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 **9**

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 **9**

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

UNIT – V **9**

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.

TOTAL : 45

REFERENCE BOOKS:

1. Ranier Handel, Manfred N Huber, Stefan Schrodder, "ATM Networks-concepts, protocols, applications", 3rd Edition, Addison 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 and Architectures", McGraw Hill, New York.1998.
4. Thomas G. Robertazzi, "Computer Networks and Systems: Queuing theory and Performance Evaluation", Third Edition, Springer, 2000.
5. Domenico Ferrari , Giuseppe Serazzi ,Alexandro Zeijher, " Measurement and Tuning of Computer Systems", Prentice Hall Inc,1983.

Course Outcomes:

On completion of the course the students will be able to

- get a deep insight of Network planning,design and management
- develop a Network design project estimation and tuning

14CNE02 WIRELESS SENSOR NETWORKS

(Common to Computer and Communication Engineering, Communication Systems & Control and Instrumentation Engineering)

3 0 0 3

Pre-requisites: Wireless Networks

UNIT – I **9**

Overview of Wireless Networks: Challenges for Wireless Sensor Networks - Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks -case study, Enabling Technologies for Wireless Sensor Networks.

UNIT – II **9**

Architectures : Single-Node Architecture -Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts. Physical Layer and Transceiver Design Consideration

UNIT – III **9**

MAC and Routing: MAC Protocols for Wireless Sensor Networks, IEEE 802.15.4, Zigbee, Low Duty Cycle Protocols And Wakeup Concepts -S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols -Energy-Efficient Routing, Geographic Routing.

UNIT – IV **9**

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT – V **9**

Data Management and Security : Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Data aggregation, Directed diffusion, Tiny aggregation, greedy aggregation, security in WSN.

TOTAL : 45

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran, " Wireless Sensor Networks" John Wiley, 2010
2. Yingshu Li, My T. Thai,Weili Wu, " Wireless Sensor Networks and Applications", Springer, 2008
3. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
4. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007.
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks Technology, Protocols and applications", John Wiley, 2007.
6. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
7. Bhaskar Krishnamachari, "Networking Wireless Sensors", Cambridge Press, 2005.
8. Mohammad Ilyas and Imad Mahgaob, "Handbook of Sensor Networks : Compact Wireless And Wired Sensing Systems", CRC Press, 2005.
9. Wayne Tomasi, "Introduction to Data Communication and Networking", Pearson Education, 2007.

Course Outcomes:

On completion of the course the students will be able to

- appreciate the need for designing energy efficient sensor nodes and protocols for prolonging network lifetime
- demonstrate an understanding of the different implementation challenges and the solutions approaches.

14COT14 OPTICAL NETWORKS

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Optical Communication

UNIT – I **9**

Optical System Components: Optical System Components – Couplers, Isolators Circulators, Multiplexers- Filters: Bragg Gratings,Fabry perot, Mach Zehnder Interfero meter, Optical Amplifiers, Transmitters, Detectors, Switches, Wavelength converters

UNIT – II **9**

Network Design And Management: Transmission System Engineering – System Model, Power Penalty, Transmitter, Receiver, Optical amplifiers, Crosstalk, Dispersion, Fiber Non-linearity, Wavelength Stabilization.

Control and Management – Network management functions, Configuration management, Performance and Fault management, Optical safety.

UNIT – III **9**

Optical Network Architecture and Survivability: Introduction to Optical Networks; SONET / SDH, Layered Architecture, Broadcast and Select Networks, IP, MAC Protocols and Test beds.

Network Survivability – Protection in SONET / SDH and IP Networks, Optical Layer Protection, Internetworking between layers.

UNIT – IV **9**

Wavelength Routing: WDM Network Elements; WDM Network Design – Cost trade-offs, LTD and RWA, Dimensioning Wavelength-Routing Network, Statistical Dimensioning models.

UNIT – V **9**

Packet Switching: Photonic Packet Switching – OTDM, Synchronization, Header Processing, Buffering, Burst Switching, Access Networks.

Total : 45

REFERENCE BOOKS:

1. Rajiv Ramaswami and Kumar N.Sivarajan, "Optical Networks: A Practical Perspective", Harcourt Asia Pte Ltd., Second Edition 2006.
2. Siva Rama Moorthy C and Mohan Gurusamy, "WDM Optical Networks: Concept Design and Algorithms", PHI, 1st Edition 2002.
3. Biswanath Mukherjee, "Optical WDM Networks", Springer, 2006.
4. Keiser Gerd., "Optical Fiber Communication", Fourth Edition, Tata McGraw-Hill, New Delhi, 2009
5 Franz and Jain, "Optical Communication System", Narosa Publications, New Delhi, 2001.

Course Outcomes:

On completion of the course the students will be able to

- design and evaluate the performance of various optical network architectures and wavelength routing models
- analyze and assess the future trends in optical network architecture

14CNE03 JAVA TECHNOLOGIES

3 0 0 3

UNIT – I **9**

Java Fundamentals : Introduction – Java and Internet – Overloading – overriding – abstract classes – interfaces – access control – exceptional handling – Built-in and User defined exceptions –Threading – I/O classes and Interfaces – File – Byte and Character Stream-Swing

UNIT – II **9**

Network Programming in Java : Basics of networking – networking classes and interfaces – Internet Address - Sockets – URL – UDP datagrams – multicast sockets –URL classes – Reading Data from the server – writing data – configuring the connection– Reading the header – telnet application – Java Messaging services.

UNIT – III **9**

Applications in Distributed Environment: Remote method Invocation – activation models – RMI custom sockets – Object Serialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services –Models - JAR file creation

UNIT – IV **9**

Multi-Tier Application Development : Server side programming – Servlets – Java Server Pages - Applet to Applet communication – JDBC – Multimedia streaming applications – Google Web toolkit- Java Media Framework-J2ME overview – CLDC and CDC - J2ME architecture and development environment

UNIT – V **9**

Enterprise Technologies : J2EE Architecture - Enterprise Application development –RMI and IIOP – Enterprise JavaBeans - EJB roles and classifications – Java Authorization and Authentication Service - Session Bean – Entity Bean – Bean and Container Managed Persistence– Message Driven Bean — MVC-Architectural guidelines in J2EE.

TOTAL : 45

REFERENCE BOOKS:

1. Schildt, Herbert, "Java 2: The Complete Reference", Eighth Edition, Tata McGraw Hill, 2011.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly publishers, Fourth Edition, 2013.
3. Hortsmann and Cornell, "Core java 2 advanced features, vol II", Ninth Edition, Pearson Education, 2013.
4. Asbury, Stephen and Weiner, Scott R., "Developing Java Enterprise Applications", Second Edition, Wiley Publications, 2001.

Course Outcomes:

On completion of the course the students will be able to

- identify advanced Java concepts and technologies
- apply the concepts for different kinds of communication patterns including applet and servlet communication
- develop applications rapidly by using Sockets, CORBA and JDBC connectivity
- design and development for enterprise applications

14CNE04 SIMULATION OF COMMUNICATION SYSTEMS AND NETWORKS

3 0 0 3

UNIT – I **9**

Introduction to Modeling and Simulation: Introduction, Discrete-event Simulation, Modeling for Computer Simulation, Tools and Methods for Network Simulation, Simulation Platform & Framework, Tools and Modeling, Approaches for Simulating Hardware, Monte Carlo Simulation concept and examples, Modeling and simulation of waveform channels

UNIT – II **9**

Simulation of Random Process and Performance Measures : Univariate and multivariate 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 **9**

Estimation of Performance Measures: Quality of an estimator, Estimator for SNR, Probability density functions of analog communication system, BER of digital communication systems, Monte Carlo method and Importance of sampling method, Estimation of power spectral density

UNIT– IV **9**

Network and Traffic Modeling : Queuing theory related to network modeling, Simulating Queuing Systems, M/M/I and M/M/I/N queues, Little formula, Burke's theorem, M/G/I queue - Single-server and multi-server queues - Embedded Markov chain analysis of TDM systems, Polling, Random access systems

UNIT – V **9**

Network of Queues : Queues in tandem, Store and forward communication networks, Capacity allocation, Congestion and flow control, Routing algorithms, Network layout and Reliability

TOTAL : 45

REFERENCE BOOKS:

1. K.Wehrie. Gunes, J.Gross, "Modeling and Tools for Network Simulation", Springer, 2010
2. Nejat; Bragg, Arnold, "Recent Advances in Modeling and Simulation Tools for Communication Networks and Services ", Springer, 2007
3. M.C. Jeruchim, P.Balaban and K. Sam Shanmugam, "Simulation of Communication Systems: Modeling, Methodology and Techniques", Plenum Press, New York, 2001
4. William.H.Tranter, K. Sam Shanmugam, Theodore. S. Rappaport, Kurt L. Kosbar, "Principles of Communication Systems Simulation", Pearson Education (Singapore) Pvt. Ltd, 2004
5. J.F.Hayes, "Modeling and Analysis of Computer Communication Networks (Applications of Communication Theory)", Plenum Press, 1984
6. K. Trivedi,Wiley. "Probability and Statistics with Reliability, Queuing and Computer Science Applications", 2nd Edition, 2002

Course Outcomes:

On completion of the course the students will be able to

- understand the role of important elements of simulation and modeling paradigm
- perform simulation of Monte Carlo techniques to different random situations
- analyze event driven simulation parameters for performance measures of communication systems
- design various queuing models that can be used to queuing related applications
- illustrate the analytical method of queuing networks for performance modeling of communication networks

14CNE05 NETWORK ROUTING ALGORITHMS

3 0 0 3

UNIT – I **9**

Circuit switching networks: AT & T's Dynamic Routing Network, Routing in Telephone Network-Dynamic Non Hierarchical Routing- Trunk Status Map Routing-Real Time Network Routing, Dynamic Alternative Routing-Distributed Adaptive Dynamic Routing-Optimized Dynamic Routing

UNIT – II **9**

Packet switching networks: Distance vector Routing, Link State Routing, Inter domain Routing-Classless Inter Domain Routing (CIDR), Interior Gateway Routing Protocols (IGRP) - Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Exterior Gateway Routing Protocol (EGRP) - Border Gateway Protocol (BGP), Apple Talk Routing and SNA Routing

UNIT - III **9**

High speed networks: Routing in optical networks-The optical layer, Node Designs, Network design and operation, Optical layer cost tradeoffs, Routing and wavelength assignment, Architectural variations, Routing in ATM networks- ATM address structure, ATM Routing, PNNI protocol, PNNI signaling protocol, Routing in the PLANET network and Deflection Routing.

UNIT - IV **9**

Mobile networks: Routing in Cellular Mobile Radio Communication networks-Mobile Network Architecture, Mobility management in cellular systems, Connectionless Data service for cellular systems, Mobility and Routing in Cellular Digital Packet Data (CDPD) network, Packet Radio Routing-DARPA packet radio network, Routing algorithms for small, medium and large sized packet radio networks.

UNIT - V **9**

Mobile Adhoc Networks (MANET): Internet based mobile ad-hoc networking, communication strategies, routing algorithms – Table-driven routing - Destination Sequenced Distance Vector (DSDV), Source initiated on-demand routing- Dynamic Source Routing (DSR), Ad-hoc On- demand Distance Vector (AODV), Hierarchical based routing- Cluster head Gateway Switch Routing (CGSR) and Temporally-Ordered Routing Algorithm (TORA), Quality of Service

TOTAL : 45

REFERENCE BOOKS:

1. M. Steen strub, "Routing in Communication networks", Prentice Hall International, NewYork, 1995.
2. "Internetworking Technologies Handbook", ILSG CiscoSystems Inc, Fourth Edition, 2003.
3. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", PHI, New Delhi, 2004.
4. Behrouz A Forouzan, "Data Communications and Networking (3/e), TMH, 2004
5. William Stallings, "High Speed Networks TCP/IP and ATM Design Principles", Prentice Hall International, New York, 1998.
6. Mohammad Ilyas, " The Handbook of Ad hoc Wireless Networks" , CRC Press, 2002.
7. Vijay K.Garg, "Wireless Network Evolution: 2G to 3G", Pearson Education, New Delhi, India, 2003.

Course Outcomes:

On completion of the course the students will be able to

- apply knowledge for identifying a suitable routing algorithm, implementing it and analyzing its performance.
- design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications.

14CNE06 ADHOC NETWORKS

3 0 0 3

UNIT – I **9**

Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

UNIT – II **9**

Adhoc/Sensor Networks: Definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of adhoc network, adhoc network architecture, data dissemination and gathering.

UNIT – III **9**

MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

UNIT – IV **9**

Routing Protocols : Issues in designing a routing protocol, classification of routing protocols,table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

UNIT – V **9**

QoS and Energy Management : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes

TOTAL : 45

REFERENCE BOOKS:

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless Networks ", Pearson Education, 2008.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks ", Elsevier Publication, 2004.
3. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003
4. William Stallings, "Wireless Communications and Networks ", Pearson Education , 2004

Course Outcomes:

On completion of the course the students will be able to

- simulate an adhoc network
- analyse various critical parameters in deploying network

14MSE05 CLOUD COMPUTING

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction: Overview – Cloud Components – Infrastructure – Services- Applications – Benefits – Limitations – Security Concerns – Regularity Issues. Hardware and Infrastructure – Clients –Security –Network –Services – Accessing the Cloud – Platforms, Applications.

UNIT – II **9**

Cloud delivery model: Software as a Service - Service providers – Services and Benefits. Platform as a Service - Service providers – Services and Benefits. Infrastructure as a Service - Service providers- Services and Benefits. Cloud deployment model : Public clouds – Private clouds – Community clouds - Hybrid clouds – Commoditization in cloud computing and Advantages of Cloud computing

UNIT – III **9**

Virtualization: Virtualization and cloud computing – Virtualization benefits- Server virtualization – VM, Hardware virtualization – OS virtualization - Storage virtualization –Network attached storage - Cloud Server virtualization – Networking essential to cloud. Microsoft Implementation: Microsoft Hyper V- VMware features and infrastructure – Virtual Box - Thin client.

UNIT – IV **9**

Using Cloud Services: Collaborating on Calendars, Schedules and Task Management - Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management –Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files. Collaborating via Web-based communication tools

UNIT – V **9**

Cloud Security and Case Study: Federation in Cloud – Presence in cloud – Privacy and its relation to Cloud based information systems. Security in Cloud. Case Study: OpenStack

TOTAL : 45

REFERENCE BOOKS:

1. Anthony T.Velte , Toby J. Velte Robert Elsenpeter, “Cloud Computing - A practical approach”, Tata McGraw- Hill , New Delhi, 2010.
2. Rittinghouse John W, Ransome James F, “Cloud Computing-Implementation, Management and Security”, CRC Press, Taylor and Francis Group, 2012.
3. Michael Miller, Cloud Computing, “Web-Based Applications that Change the Way You Work and Collaborate Online”, Que Publishing, 2008.
4. Kumar Saurabh, “Cloud Computing”, Wiley India Pvt. Ltd, Second Edition, 2012.

Course Outcomes:

On the completion of the course the students will be able to

- explore online applications of cloud services
- implement cloud computing for the corporation
- design various applications by integrating cloud services

14MSE17 SOFT COMPUTING

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Basic knowledge of elementary calculus and linear algebra

UNIT – I **9**

Artificial Neural Network Introduction to Soft Computing, Artificial Neural Network: Supervised Learning Networks, Associative Memory Networks

UNIT - II **9**

Unsupervised Learning Introduction, Fixed weight competitive networks, Kohonen SOM, Learning Vector Quantization, Counter Propagation Network, Adaptive Resonance Theory Network : ART1 and ART2, Special Networks

UNIT – III **9**

Fuzzy Logic: Introduction: Fuzzy Logic, Classical Sets, Fuzzy Sets, Classical Relation and Fuzzy relation, Membership Functions, Defuzzification, Fuzzy Rule-Base and Approximate Reasoning

UNIT– IV **9**

Genetic Algorithm: Introduction, Traditional optimization and search Techniques, Search Space, Operators, Stopping Condition, Constraints, Problem Solving, Schema Theorem, Classification, Holland Classifier System, Genetic Programming

UNIT – V **9**

Hybrid Soft Computing Techniques: Introduction, Neuro-Fuzzy Hybrid System, Genetic-Neuro Hybrid System, Genetic-Fuzzy Hybrid System, Fuzzy-Genetic Hybrid System, Simplified Fuzzy ARTMAP, Application of Soft Computing, CASE Study.

TOTAL : 45

REFERENCE BOOKS:

1. S.N. Sivanandan and S.N. Deepa, “Principles of Soft Computing”, Wiley India, 2007. ISBN: 10: 81-265-1075-7.
2. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
3. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education.

Course Outcomes:

On completion of the course the students will be able to

- identify and describe soft computing techniques and their roles in building intelligent machines
- recognize the feasibility of applying a soft computing methodology for a particular problem
- identify and select a suitable Soft Computing technology to solve the problem; and construct a solution and implement a Soft Computing solution
- design Soft Computing Systems by hybridizing various other techniques

14MST14 MOBILE AND PERVASIVE COMPUTING

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction to Wireless Environment: Introduction to wireless communication-Wireless transmission- Medium Access Control- Wireless MAC protocols -Wireless LANs - WAP-Current trends in wireless network-2G, 3G, looking ahead 4G concepts - Wireless IEEE standards.

UNIT – II **9**

Mobile Communication: GSM - DECT system - TETRA and UMTS - Bluetooth - Wi-Fi – WiMAX - Mobile network layer-Mobile transport layer - Cellular networks - Mobility management - Mobile transaction and commerce-Protocols for mobile commerce - File system support for mobility support - Mobile execution environments and applications.

UNIT – III **9**

Pervasive Communication: Pervasive computing principles - Characteristics of pervasive computing environments -Vision and challenges of pervasive computing - Pervasive computing applications and case study - Pervasive Web Application architecture - Pervasive computing and web based applications- Voice enabling pervasive computing- PDA in pervasive computing- User interface issues in pervasive computing

UNIT – IV **9**

Context Aware Computing: Structure and Elements of Context-aware Pervasive Systems : Abstract architecture – Infrastructures - Middleware and toolkits, Context-aware mobile services : Context for mobile device users – Location-based services- Ambient service- Enhancing Context-aware mobile services and Context aware artifacts

UNIT – V **9**

Context-Aware Pervasive System: Context-aware sensor networks – A framework for Context-aware sensors – Context-aware security systems – Constructing Context-aware pervasive system- Future of Content aware systems

TOTAL : 45

REFERENCE BOOKS:

1. Schiller, Jochen., “Mobile Communications”, Second Edition, PHI/Pearson Education, 2009.
2. Burkhardt Jochen, Henn Horst and Hepper Stefan, Schaec Thomas and Rindtorff Klaus., “Pervasive Computing Technology and Architecture of Mobile Internet Applications”, Addison Wesley Reading, 2007.
3. Seng Loke, “Context-Aware Pervasive Systems: Architectures for a New Breed of Applications”, Auerbach Publications, First Edition, 2006
4. Stallings William, “Wireless Communications and Networks”, Second Edition, PHI/Pearson Education, 2009.
5. Toh, C. K. “Ad Hoc Mobile Wireless Networks: Protocols and Systems,” Prentice Hall, New Delhi, 2002.

Course Outcomes:

On completion of the course the students will be able to

- describe the operation and performance of wireless protocols and provide most recent development in wireless mobile systems
- summarize the concepts and principles of various mobile communication technologies
- demonstrate the working of protocols that support mobility
- illustrate architecture of pervasive computing and identify the applicability of pervasive computing

14CNE07 SOFTWARE QUALITY ASSURANCE AND TESTING

3 0 0 3

UNIT – I **9**

Software Quality Metrics: Software Measurement and Metrics – Measurement Theory – Software quality metrics – Product quality metrics – Software maintenance metrics – Collecting software engineering data.

UNIT – II **9**

Software Quality Assurance: Software quality in business context – Planning for software quality assurance – Product quality and process quality – Software process models – ISO – Capability Maturity Model – CMMi – People CMM – Test Maturity Model

UNIT – III **9**

Testing Fundamentals: Principles of testing - Software development life cycle models-Types of testing- White box testing- Black box testing- Integration Testing –System and acceptance testing- Performance testing -Regression testing – Internalization testing – Ad hoc testing – Testing of object oriented systems – Usability and accessibility testing.

UNIT – IV **9**

Test Management and Automation: Introduction – Test Planning – Test Management –Software test automation – Scope of automation – Test automation tools – Generic requirement for test tool/framework – Selecting a test tool – Challenges in automation.

UNIT – V **9**

Testing Projects: Managing Testing projects and groups – Legal consequences of defective software – Managing a testing group – Role of testing group.

TOTAL : 45

REFERENCE BOOKS:

1. Nina S Godbole, "Software Quality Assurance: Principles and Practice", Narosa Publishers, New Delhi, 2004.
2. Gopalswamy Ramesh and Srinivasan Desikan, "Software Testing: Principles and Practices", Pearson Education, New Delhi, 2006.
3. Stephen H Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, New Delhi, 2002.
4. Daniel Galin, Software Quality Assurance – From Theory to Implementation , Pearson Education, 2009
5. Glenford J Myers, Corey Sandler, Tom Badgett and Todd M Thomas, "The Art of Software Testing", Wiley, USA, 2004.
6. William E Perry, "Effective Methods for Software Testing", Wiley, New York, 2000.

Course Outcomes:

On completion of the course the students will be able to

- appreciate the importance of software quality assurance and the metrics
- apply software testing techniques for information systems development

14MSE04 BUSINESS INTELLIGENCE

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction to Business Intelligence: Introduction to Digital Data and its Types – Structured, Semi-structured and Unstructured Data - Introduction to OLTP and OLAP – Architectures – Data Models – Role of OLAP in BI – OLAP Operations – Business Intelligence - BI Definition and Evolution – BI Concepts - BI Component Framework – BI Process, Users, Applications – BI Roles – BI Best Practices – Popular BI Tools.

UNIT – II **9**

Data Integration: Need for Data Warehouse – Definition of Data Warehouse – Data Mart – Ralph Kimball's Approach vs. W.H.Inmon's Approach – Goals of Data Warehouse – ETL Process – Data Integration Technologies – Data Quality – Data Profiling – Case Study from Healthcare domain – Kettle Software: Introduction to ETL using Pentaho Data Integration

UNIT – III **9**

Multidimensional Data Modeling: Basics of Data Modeling – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension Table – Dimensional Models - Dimensional Modeling Life Cycle – Designing the Dimensional Model - Measures, Metrics, KPIs and Performance Management – Understanding Measures and Performance – Measurement System - Role of metrics – KPIS - Analyze Data using MS Excel 2010

UNIT – IV **9**

Basics of Enterprise Reporting: Reporting Perspectives - Report Standardization and Presentation Practices– Enterprise Reporting Characteristics - Balanced Scorecard - Dashboards - Creating Dashboards - Scorecards vs. Dashboards - Analysis - Enterprise Reporting using MS Access / MS Excel

UNIT – V **9**

BI Applications and Case Studies: Understanding Business Intelligence and Mobility – Business Intelligence and Cloud Computing – Business Intelligence for ERP Systems – Social CRM and Business Intelligence - Case Studies : Good Life HealthCare Group, Good Food Restaurants Inc., TenToTen Retail Stores

TOTAL: 45

REFERENCE BOOKS:

1. N.Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley-India Publication, 2011 Edition, Reprint 2012.
2. Efraim Turban, Ramesh Sharda, Dursun Delen, David King, "Business Intelligence: A Managerial Approach", Second Edition, Pearson Education, 2011.
3. David Loshin, "Business Intelligence", Morgan Kaufmann Publishers, San Francisco, Fifth Edition, 2007
4. Mike Biere, "Business Intelligence for the Enterprise", Pearson Education, Tenth Edition, 2008
5. Larissa Terpeluk Moss, Shaku Atre, "Business Intelligence Roadmap", Pearson Education, 2007

Course Outcomes:

On the completion of the course the students will be able to

- describe about key elements of Data Warehouse and Business Intelligence
- explain about analysis, integration and reporting services
- identify the functionalities of Key Performance Indicators

14MSE06 COMPILER DESIGN TECHNIQUES

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction: Language Processors - The Structure of a Compiler – The Evolution of Programming Languages-– Applications of Compiler Technology Programming Language Basics - The Lexical Analyzer Generator -Parser Generator -Intermediate Code Generation techniques - Overview of Basic Blocks and Flow Graphs - Optimization of Basic Blocks - Principle Sources of Optimization.

UNIT – II **9**

Instruction Parallelism: Processor Architectures – Code-Scheduling Constraints – Basic-Block Scheduling –Global Code Scheduling – Software Pipelining.

UNIT - III **9**

Optimizing for Parallelism and Locality: Basic Concepts – Matrix-Multiply: An Example - Iteration Spaces - Affine Array Indexes – Data Reuse Array data dependence Analysis.

UNIT - IV **9**

Optimizing for Parallelism and Locality – Application: Finding Synchronization - Free Parallelism – Synchronization between Parallel Loops – Pipelining– Locality Optimizations – Other Uses of Affine Transforms.

UNIT – V **9**

Interprocedural Analysis: Basic Concepts – Need for Inter procedural Analysis – A Logical Representation of Data Flow – A Simple Pointer-Analysis Algorithm – Context Insensitive Inter procedural Analysis - Context-Sensitive Pointer-Analysis – Data log Implementation by Binary Decision Diagrams.

TOTAL: 45

REFERENCE BOOKS:

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2008.
2. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
3. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003

Course Outcomes:

On the completion of the course the students will be able to

- design and implement scanner and parser by using its own pattern
- use the knowledge of patterns, tokens and regular expressions for solving a problem in the field of data mining
- apply the new code optimization techniques to improve the performance of a program in terms of speed and space
- explore the architectural design of the system
- evaluate the knowledge needed for modern compiler and its features

14MSE02 BIG DATA ANALYTICS

(Common to Computer Science and Engineering & Computer and Communication Engineering)

3 0 0 3

UNIT – I **9**

Introduction to Big Data: Analytics – Nuances of Big Data – Value – Issues – Case for Big Data – Big Data options Team challenge – Big Data sources – Acquisition – Nuts and Bolts of Big Data - Features of Big Data - Security, Compliance, Auditing and Protection - Evolution of Big Data – Best Practices for Big Data Analytics - Big Data Characteristics - Volume, Veracity, Velocity, Variety – Data Appliance and Integration Tools – Greenplum – Informatica.

UNIT – II **9**

Data Analysis: Evolution of Analytic Scalability – Convergence – Parallel Processing Systems – Cloud Computing – Grid Computing – Map Reduce – Enterprise Analytic Sand Box – Analytic Data sets – Analytic Methods – Analytic Tools – Cognos – Microstrategy – Pentaho - Analysis Approaches – Statistical Significance – Business Approaches – Analytic Innovation – Traditional Approaches – Iterative.

UNIT – III **9**

Stream Computing: Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting distinct elements in a Stream – Estimating Moments – Counting oneness in a Window – Decaying Window - Realtime Analytics Platform(RTAP) Applications - IBM Infosphere – Big Data at rest – Infosphere Streams – Data Stage – Statistical Analysis – Intelligent Scheduler – Infosphere Streams.

UNIT- IV **9**

Predictive Analytics and Visualization: Predictive Analytics – Supervised – Unsupervised Learning – Neural Networks – Kohonen Models – Normal – Deviations from Normal Patterns – Normal behaviours – Expert options – Variable entry - Mining Frequent Itemsets - Market based model – Apriori Algorithm – Handling large data sets in main memory – Limited Pass algorithm – Counting Frequent Itemsets in a Stream – Clustering Techniques – Hierarchical – K Means Clustering- High Dimensional Data Visualizations - Visual data Analysis Techniques - Interaction Techniques: Systems and Applications.

UNIT- V FRAMEWORKS AND APPLICATIONS **9**

IBM for Big Data – Map Reduce Framework - Hadoop – Hive – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Hbase – Impala – Analyzing Big Data with Twitter – Big Data for Ecommerce – Big Data for Blogs.

TOTAL : 45

REFERENCE BOOKS:

1. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.
2. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier, 2007.
4. Michael Berthold, David J. Hand, ” Intelligent Data Analysis”, Springer, 2007.
5. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

Course Outcomes:

On completion of the course the students will be able to

- describe the concepts and characteristics of Big Data
- recognize the usage of data analytics and its related tools
- discuss the concept of stream computing and real time applications
- categorize the predictive analysis techniques and determine the use of Hadoop frameworks

14COT11 STATISTICAL SIGNAL PROCESSING

(Common to Communication Systems, VLSI Design, Embedded Systems & Computer and Communication Engineering)

3 1 0 4

Pre-requisites: Digital Signal Processing

UNIT – I **9**

Discrete Random Signal Processing: Discrete time random process – Random process: Ensemble averages- Gaussian process – stationary process – The autocovariance and autocorrelation matrices – ergodicity – white noise the power spectrum. Filtering random process – spectral factorization. Parseval's theorem – Wiener Khintchine relation.

UNIT – II **9**

Spectrum Estimation and Analysis: Non parametric methods: Periodogram, performance of periodogram, modified periodogram, Bartlett's method, Welch's method.

Parametric methods: AR model – Yule-Walker method, MA model – ARMA model.

UNIT – III **9**

Linear Prediction: Forward and backward linear predictions, Solution of the normal equations – Levinson-Durbin algorithms. Least mean squared error criterion – The FIR Wiener filter – filtering – linear prediction and The IIR Wiener filters – Non causal IIR Wiener filter – the causal IIR Wiener filter.

UNIT – IV **9**

Adaptive Filter: Concepts of adaptive filter – FIR adaptive filters – LMS algorithm – Applications: Noise cancellation-Adaptive recursive filers– AR lattice structure and ARMA process, lattice – ladder filters.

UNIT – V **9**

Overview of speech processing : Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Short time Homomorphic Filtering of Speech; Linear Prediction (LP) analysis: Basis and development, LPC spectrum.

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS:

1. Hayes, Monson H. "Statistical Digital Signal processing and Modeling", John Wiley and Sons, Inc., 1996
2. Proakis, John G. and Manolakis, Dimitris G. "Digital Signal Processing: Principles Algorithms and Applications", PHI, 2006.
3. Ifeachor, Emmanuel C. and Jervis, Barrie N. "Digital Signal Processing: A Practical Approach", Addison-Wesley Publishing Company, 2002.

Course Outcomes:

On completion of the course the students will be able to

- demonstrate the concepts of discrete random signal processing in real time applications
- estimate and analyze the spectrum using parametric and non-parametric approach
- design an adaptive filter and various error minimization algorithm for speech quality improvement

14COT15 TRANSFORM TECHNIQUES

(Common to Communication Systems & Computer and Communication Engineering)

3 1 0 4

Pre-requisites: Signals and Systems, Digital Signal Processing

UNIT – I **9**

Orthogonal Functions: Orthogonal signal spaces, approximations of functions by a set of mutually orthogonal functions, Orthogonality in complex functions, trigonometric & exponential Fourier series, Hilbert Transforms, Properties and its applications in communication.

UNIT – II **9**

Two Dimensional Transforms and its Applications I: Concept of two dimensional Fourier transforms – properties & their significance, energy & power spectral density functions- Walsh transforms, Hadamard transform, Haar Transform.

UNIT – III **9**

Two Dimensional Transforms And Its Applications II: Transform based lossy and lossless compression, Slant Transform, Discrete Cosine Transform,KL Transform, Hough Transform, Radon Transform. Short time Fourier transform & properties of STFT

UNIT – IV **9**

Wavelet Transforms: CWT - inverse CWT, Introduction to Discrete Wavelet Transform ,Multi-resolution analysis (MRA),Relationship to filter banks, orthogonal wavelets-Types & their applications

UNIT – V **9**

Multi Scale Transforms: Contourlet, Bandlet,, Curvelet, Ridgelet transforms-Properties & their applications

Lecture: 45, Tutorial: 15, TOTAL: 60

REFERENCE BOOKS:

1. Lathi B.P, "Signals & Systems", BS Publishers 1/e, 2004
2. Raghuveer.M.Rao, Ajit S Bopardikar "Wavelet transforms-introduction to theory & applications", Pearson education, Asia.
3. Anil.K.Jain, "Fundamentals of Digital Image processing" 2/e, Pearson.
4. Gonzalez.C& Redwoods "Digital Image Processing", 1/e 2001
5. Jaideva C.Goswami, Andrew K.Chan, "Fundamentals of wavelets-Theory, Algorithms & applications", John Willey & Sons.
6. S.Jayaraman,S.Essakirajan,T.Veerakumar,"Digital Image Processing" Tata McGraw-Hill Education, 2011.
7. K.P Soman,K.I Ramachandran,"Insight into wavelets From Theory to practice" 2/e, PHI learning private limited,2010

Course Outcomes:

On completion of the course the students will be able to

- analyze the various applications of transform techniques in communication systems
- solve various problems in the design of a new communication system

14COE01 CDMA ENGINEERING

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Digital Communication

UNIT – I **9**

Principles of Code Division Multiple Access: Spread spectrum technique – Direct sequence and frequency hopping spread spectrum communication system – PN codes and Walsh codes – Rake receiver – Capacity – Effects of loading, sectorization and voice activity – Power control – Hand off – Link structure – Forward link – Pilot, synchronization, paging and traffic channels – Reverse Link – access and traffic channel

UNIT – II **9**

Call Processing and Traffic: Call processing states – Initialization, idle, access and traffic states – Forward link and Reverse link analysis - Calculation of E_c/I_o and E_b/N_o – Traffic intensity – Grade of Service – Erlang-B and C models

UNIT – III **9**

WCDMA Basics: Protocol architecture, principles of physical layer, Spreading codes and modulation- Introduction- channelization codes- Scrambling codes-modulation- uplink , downlink spreading and modulation

UNIT – IV **9**

OFDMA and MC-CDMA: OFDM principles , Frequency hopping in OFDMA - OFDMA system description – Channel coding, modulation, time and frequency synchronization, Combination of OFDM and CDMA - MC-CDMA, MT-CDMA and MC-DS CDMA systems - Difference between OFDMA and MC-CDMA

UNIT – V **9**

Optical CDMA: Families of Prime Codes- Prime code, Generalized and Extended Prime Codes, Experimental demonstration of Optical CDMA, Synchronization of Optical CDMA networks-Cross-correlation properties, Application, Temporal-Spatial CDMA Optical Network, Multiwavelength Optical CDMA networks

TOTAL : 45

REFERENCE BOOKS:

1. Samuel C Yang, "CDMA RF System Engineering", Artech House, 1998.
2. Richard Van Nee and Ramjee Prasad, "OFDM for wireless Multimedia Communication", Artech House, 2000.
3. Andrew Richardson ,"WCDMA Design Handbook", Cambridge university press, 2005.
4. Khaled Fazal and Stephen Kaiser, "Multicarrier and Spread Spectrum Systems," 2008
5. Guu-Chang Yang, "Prime Codes with Application to Optical and Wireless Networks", Artech House, Inc., 2002.

Course Outcomes:

On completion of the course the students will be able to

- demonstrate basic spread spectrum techniques and different CDMA techniques
- apply his knowledge on basic principles behind radio resource management techniques such as power control, channel allocation and handoffs in different CDMA techniques
- identify the suitable modulation techniques for the given channel environment

14COE10 MULTICARRIER COMMUNICATION

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Digital Communication, Cellular and Mobile Communication

UNIT – I **9**

Introduction to Multicarrier Systems: Linear Algebra: Vector Spaces, Linear independence, Subspaces, Projections, Orthogonality, Eigen Decomposition, Quadratic forms, Digital Communication Review: Linear stream modulation, Optimal Detection, ISI channels, Equalization

UNIT – II **9**

Multicarrier Fundamentals: Motivation, OFDM, Subcarrier notion, Role of FFT, Parallel channel decomposition and detection, OFDM Transmitter Optimization: Adaptive Modulation, Waterfilling

UNIT – III **9**

Multicarrier Receivers: SNR gap analysis, Bit loading algorithms, Linear precoding, Coded OFDM, OFDM Receiver Algorithms : Synchronization, Sensitivity to timing and frequency errors

UNIT – IV **9**

Channel Estimation and Equalization: Zero forcing and MMSE algorithms, Training sequence design, Multiuser Systems: OFDMA, SCFDMA, Distributed and localized mapping.

UNIT – V **9**

Multicarrier Diversity: Multiuser diversity, Resource allocation algorithms, Applications to cellular systems, MIMO-OFDM: Fundamental MIMO concepts, Spatial diversity, Spatial Multiplexing, Space Frequency coding

Total : 45

REFERENCE BOOKS:

1. Hanzo L and Keller T, OFDM and MCCDMA a primer, John Wiley and Sons, 2006.
2. Proakis G, Digital Communications, New York McGraw Hill, 2001
3. Strang G, Linear Algebra and Applications, New York Academic, 1980.
4. Tse D and Vishwanath P, Fundamentals of wireless communications, Cambridge Press, 2005.
5. Van Nee R and Prasad R, OFDM for Wireless Multimedia Communications , Artech House Publishers, 1999
6. Chiueh T.D and Tsai P.Y, OFDM Baseband Receiver Design for Wireless Communications, Wiley, 2007

Course Outcomes:

On completion of the course the students will be able to

- demonstrate the trade-offs involved in the design of modulation coding techniques
- design the baseband signaling waveforms for a particular user requirement and type of channel over which the system has to function

14COE11 SPREAD SPECTRUM COMMUNICATION

(Common to Communication Systems & Computer and Communication Engineering)

3 0 0 3

Pre-requisites: Digital Communication

UNIT – I **9**

Performance characterization of digital data transmission: Detection of binary signals in AWGN - Quadrature multiplexed signaling schemes - Equalization of digital data transmission system - Communication in the presence of pulse noise jamming - Low probability detection scheme

UNIT – II **9**

Spread spectrum systems: Direct sequence spread spectrum methods employing BPSK, QPSK and MSK - Frequency Hop spread spectrum methods - Coherent slow frequency Hop technique - Non coherent slow and fast frequency Hop spread spectrum techniques - Hybrid DS/FH spread spectrum

UNIT – III **9**

Binary shift register sequences for spread spectrum systems: Definition - PN sequence generator fundamentals - Maximal length sequences - Properties, Power spectrum and Polynomial tables for maximal length sequences - Gold codes - Rapid Acquisition systems - Non-linear code generators.

UNIT – IV **9**

Synchronization of spread spectrum systems: Optimal tracking of wideband signals - Code tracking loops for FHSS - Optimum synchronization techniques - Synchronization using a matched filter - Synchronization by estimating the received spreading code.

UNIT – V **9**

Performance of Spread Spectrum System: SS Systems communications models - Performance without coding under AWGN - spread spectrum systems performances with forward error correction - Block coding - Convolutional coding and specific error correcting codes - Interleaving - Random coding bounds.

Total : 45

REFERENCE BOOKS:

1. Ziemer R E, Peterson R L and David E. Borth, "Introduction to Spread Spectrum Communications", Published by Pearson Education Pte. Ltd., 2005
2. Dixon R C, "Spread Spectrum Systems", Wiley Interscience, 1976
3. Holms J K, "Coherent Spread Spectrum Systems", Wiley Interscience, 1982.

Course Outcomes:

On completion of the course the students will be able to

- utilize the concept of digital data transmission from fundamental to recent technology
- evaluate the performance of spectral characterization of spread spectrum system on different transmission medium

14COE05 DIGITAL IMAGE PROCESSING AND MULTI RESOLUTION ANALYSIS

(Common to Communication Systems, VLSI Design, Embedded Systems, Computer and Communication Engineering & Mechatronics)

3 0 0 3

Pre-requisites: Digital Signal Processing

UNIT – I **9**

Image Transforms: Orthogonal transforms – FT,DST,DCT, Hartley, Walsh hadamard, Haar, Radon, Slant Wavelet, KL, SVD and their properties

UNIT – II **9**

Image Enhancement and Restoration: Image enhancement - Point operations - contrast stretching - clipping and thresholding - digital negative intensity level slicing - bit extraction. Histogram processing - histogram equalisation -modification. Spatial operations – smoothing spatial filters, sharpening spatial filters. Transform operations. Color image enhancement. Image Restoration – degradation model, Noise models, Unconstrained and Constrained restoration, Inverse filtering – removal of blur caused by uniform linear motion, Wiener filtering, Restoration by SVD and Homomorphic filtering

UNIT – III **9**

Image Compression: Image Compression – Need for data compression – Run length encoding – Huffman coding – Arithmetic coding – predictive coding- transform based compression, - vector quantization – block truncation coding.

Image Segmentation: Point, Edge and line detection -thresholding-Region based approach

Image Representation: boundary based – region based and intensity based description

UNIT – IV **9**

Registration and Multi valued image Processing: Registration – geometric transformation – registration by mutual information

Mutivalued image processing – colour image processing – colour image enhancement- satellite image processing- radiometric correction – other errors- multi spectral image enhancement- medical image processing – image fusion

UNIT – V **9**

Wavelets And Multiresolution Processing : Image Pyramids – Subband coding – The Haar Transform – Multiresolution Expansion – Series Expansion – Scaling Function – Wavelet Function – Wavelet Transform in One Dimension- The Wavelet Series Expansion – The Discrete Wavelet Transform – The Continuous Wavelet Transform – The Fast Wavelet Transform – Wavelet transform in two dimensions– Applications in image denoising and compression

Total : 45

REFERENCE BOOKS:

1. Chanda B, Dutta Majumder D., “Digital Image Processing and analysis”, 2nd Edition, PHI learning, 2011
2. Gonzalez, Rafel C. and Woods, Richard E., "Digital Image Processing", 2nd Edition, Prentice Hall, New York, 2006.
3. Jain, Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi, 2003.
4. Rosenfield, Azriel and Kak, Avinash C., “Digital Picture Processing”, Academic Press Inc, New York, 1982.

5. Jayaraman. S, Esakkirajan. S, and Veerakumar. T, "Digital Image Processing" Tata McGraw-Hill, New Delhi, 2009

Course Outcomes:

On completion of the course the students will be able to

- analyze and process digital images and color images in various domains
- apply concepts of wavelets in image processing for various applications