Counselling Code : **VBIT**

VIGNANA BHARATHI ®
Institute of Technology

(A UGC Autonomous Institution, Approved by AICTE, Accredited by NBA & NAAC-A Grade, Affiliated to JNTUH)

DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

R22 M.TECH. (COMMUNICATION SYSTEMS)

ACADEMIC YEAR : 2022-23

COURSE STRUCTURE & SYLLABUS

I YEAR I – SEMESTER

S. No.	Course Type	Course Code	Course Title	L	T	P	Credits
1	Professional Core -I	22CM6111	Wireless Communications and Networks	3	0	0	3
2	Professional Core -II	22CM6112	Advanced Digital Signal Processing	3	0	0	3
3	Professional Elective -I	22CM6171	1. Cognitive Radio	3	0	0	3
		22CM6172	2. TCP/IP Internetworking				
		22CM6173	3. Random Processes and Queuing Theory				
4	Professional Elective -II	22CM6174	1. 5G Communications	3	0	0	3
		22CM6175	2. Coding Theory and Techniques				
		22CM6176	3. Spread Spectrum Communications				
5	Professional Core Lab-I	22CM6151	Wireless Communications and Networks Lab	0	0	4	2
6	Professional Core Lab-II	22CM6152	Python Programming Lab	0	0	4	2
7	Mandatory Course	22MC6111	Research Methodology & IPR	2	0	0	2
8	Audit	22AU6101	Stress Management for Yoga	2	0	0	0
			Total Credits	**16**	**0**	**8**	**18**

I YEAR II – SEMESTER

S. No	Course Type	Course Code	Course Title	L	T	P	Credits
1	Professional Core -III	22CM6211	Advanced Communications and Networks	3	0	0	3
2	Professional Core -IV	22CM6212	Network Security And Cryptography	3	0	0	3
3	Professional Elective -III	22CM6271	1. Optical Communications and Networks	3	0	0	3
		22CM6272	2. Ad-hoc & Wireless Sensor Networks				
		22CM6273	3. Detection and Estimation Theory				
4	Professional Elective -IV	22CM6274	1. Machine Learning and Applications	3	0	0	3
		22CM6275	2. High Performance Networks				
		22CM6276	3. Adaptive Signal Processing				
5	Professional Core Lab-III	22CM6251	Advanced Communications and Networks Lab	0	0	4	2
6	Professional Core Lab-IV	22CM6252	Network Security And Cryptography Lab	0	0	4	2
7	Project Work	22CM6291	Mini project with Seminar	0	0	4	2
8	Audit	22AU6201	English for Research Paper Writing	2	0	0	0
			Total Credits	**14**	**0**	**12**	**18**

II YEAR I – SEMESTER

S. No.	Course Type	Course Code	Course Title	L	T	P/D	Credits
1	Professional Elective -V	22CM7171	1. Voice and Data Network	3	0	0	3
		22CM7172	2. IOT and Its Application				
		22CM7173	3. Deep Leaning				
2	Open Elective	Open Elective	--	3	0	0	3
3	Project Work	22CM7181	Dissertation Work Review – I	0	0	12	6
			Total Credits	**6**	**0**	**12**	**12**

II YEAR II – SEMESTER R-22

S. No.	Course Type	Course Code	Course Title	L	T	P	Credits
1	Project Work	22CM7281	Dissertation Work Review — II	0	0	12	6
2	Project Work	22CM7282	Dissertation Viva-Voce	0	0	28	14
			Total Credits	**--**	**--**	**40**	**20**

Audit Course 1 & 2:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by yoga
8. Personality Development Through Life Enlightenment Skills

Category of Courses :

1. Program Core – PC
2. Program Electives -PE
3. Open Elective – OE
4. Audit Course- AD
5. Mandatory Course - MC
6. Project Work-PW

22CM6111: WIRELESS COMMUNICATIONS AND NETWORKS

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives

The objectives of this course are to make the student

1. To provide the students with the fundamental treatment about many practical and theoretical concepts that forms basic of wireless communications.
2. To equip the students with various kinds of wireless networks and its operations.•
3. To provide an analytical perspective on the design and analysis of the traditional and emerging wireless networks.
4. To discuss the nature of, and solution methods to, the fundamental problems in wireless networking.
5. To train students to understand the architecture and operation of various wireless local area networks

Course Outcomes:

At the end of this course, students will be able to

1. Understand Cellular communication concepts
2. Analyze the mobile radio propagation models(large scale).
3. Analyze the small scale propagation models.
4. Demonstrate wireless Local and Wide area networks and their specifications.
5. Familiar with some of the existing and emerging wireless standards.

UNIT -I

The Cellular Concept-System Design Fundamentals: Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring .

UNIT –II

Mobile Radio Propagation: Large-Scale Path Loss: Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection-Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, Diffraction-Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley-Rice Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT –III

Mobile Radio Propagation: Small –Scale Fading and Multipath: Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke's model for flat fading, spectral shape due to Doppler spread in Clarke's model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT -IV

Equalization and Diversity: Introduction, Fundamentals of Equalization, Training A Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity Techniques-Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

UNIT -V

Wireless Networks: Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11,IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper LAN, WLL.

TEXT BOOKS:

1. Theodore, S. Rappaport, "Wireless Communications, Principle, Practice ", 2nd Edition, 2002.Pearson
1. Andrea Goldsmith, "Wireless Communications", 2005 Cambridge University Press.

REFERENCE BOOKS:

1. Kaveh PahLavenand P. Krishna Murthy, "Principles of Wireless Networks", 2002, PE
2. Gottapu Sasi bhushana Rao, "Mobile Cellular Communication", Pearson Education, 2012.
3. William Stallings, "Wireless Communication and Networking", 2003, PHI.

22CM6112: ADVANCED DIGITAL SIGNAL PROCESSING

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Digital Signal Processing

Course Objectives

The objectives of this course are to:

1. Understand the implementation of digital filters using various structures and study the advantages & disadvantages of implementation structures.
2. Study various parametric and non-parametric methods of power spectrum estimation.
3. Understand the effects of finite word length in hardware implementation of IIR filters and FFT.
4. Understand the concepts of Multirate signal Processing and their applications.

Course Outcomes

On completion of this course student will be able to:

1. Implement a filter in various forms.
2. Estimate the power spectrum of signal corrupted by noise using Non-Parametric or Parametric methods.
3. Understand finite word length effects in IIR filters and FFT.
4. Implement Multirate systems and understand the applications of Multirate signal processing.

UNIT –I

Review of DFT, FFT, IIR Filters and FIR Filters: Introduction to filter structures (IIR & FIR), Implementation of Digital Filters, specifically 2nd Order Narrow Band Filter and 1st Order All Pass Filter, Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

UNIT -II

Non-Parametric Methods: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods

UNIT - III

Parametric Methods: Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

UNIT –IV

Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion. Examples of up-sampling using an All Pass Filter.

UNIT –V

Applications of Multi Rate Signal Processing: Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Subband Coding of Speech Signals, Quadrature Mirror Filters, Transmultiplexers, Over Sampling A/D and D/A Conversion.

TEXT BOOKS

1. Digital Signal Processing: Principles, Algorithms & Applications - J.G.Proakis& D. G. Manolakis, 4th Ed., PHI.
2. Discrete Time signal processing - Alan V Oppenheim & Ronald W Schaffer, PHI.

REFERENCES

1. Modern spectral Estimation: Theory & Application – S. M .Kay, PHI, 1988.
2. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education.
3. DSP – A Practical Approach – Emmanuel C. Ifeacher, Barrie. W. Jervis, 2 Ed., Pearson Education.

22CM6171: COGNITIVE RADIO

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Knowledge of Detection and Estimation Theory

Course Objectives:

1. To explore the principle of cognitive radio.
2. To develop techniques for spectrum hole detection.
3. To learn different spectrum allocation techniques
4. To study the models and techniques for efficient utilization of spectrum
5. To study spectrum access and trading.

Course Outcomes:

At the end of this course, students will be able to

1. Gain the fundamental concepts of cognitive radio networks.
2. Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
3. Identify technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies.
4. Identify the fundamental issues regarding dynamic spectrum access.
5. Analyze the radio-resource management and trading in cognitive radio network.

UNIT –1:

Introduction to Cognitive Radios: cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

UNIT – 2:

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, Geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

UNIT – 3:

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

UNIT – 4:

Dynamic Spectrum Access and Management: cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

UNIT – 5:

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory) and classification of auctions (single auctions, double auctions, concurrent, sequential)

TEXTBOOKS:

1. Ekram Hossain,Dusit Niyato, ZhuHan,"Dynamic Spectrum Access and Management in Cognitive Radio Networks",Cambridge University Press,2009.Kwang-Cheng Chen, RamjeePrasadd, "Cognitive radio networks", John Wiley & Sons Ltd.,2009.
2. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition,2009.

REFERENCE BOOKS:

1. HuseyinArslann, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer,2007.
2. Francisco Rodrigo Porto Cavalcanti, Soren Anderson, "Optimizing Wireless Communication Systems" Springer,2009.
3. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press,2009.

22CM6172: TCP/IP INTERNETWORKING

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

The main objectives of the course are:

1.Acquire the computer networking knowledge as well as the existing connectivity technologies and the required infrastructure which comprises the key steps involved in the communication process.

2. Identify the key issues for the realization of the internetworking and network architectures, study about routers.

3. Acquire the knowledge of the basic protocols involved in communication process and introduce the concept of congestion and quality of service.

4. Introduce the student to queue management and buffer management schemes.

5. Introduce mobile network layer, transport layer , study about SCTP.

Course Outcomes

On completion of this course student will be able to

1.Explain fundamentals and technologies of physical, data-link and network layers and connecting devices.

2.Apply the internetworking concepts and internet architecture for congestion free communication.

3.Link different network performance concepts and traffic issues for Quality of Service (QoS) in broadband communication

4.Analyze queue and buffer management and apply algorithms.

5.Explain stream control transmission protocol and mobile network and transport layer.

UNIT - I

Network Models: Layered Tasks, The OSI Model, Layers in OSI Model, TCP/IP Protocol suite, Addressing.
Connecting devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.

UNIT -II

Internetworking Concepts: Principles of Internetworking, Connection less Interconnection, Application Level Interconnection, Network Level Interconnection, Properties of the Internet, Internet Architecture, Interconnection through IP Routers
TCP, UDP & IP: TCP Services, TCP Features, Segment, A TCP Connection, Flow Control, Error Control, Congestion Control, Process to Process Communication, User Datagram, Checksum, UDP Operation, IP Datagram, Fragmentation, Options, IP Addressing: Classful Addressing, IPV6.

UNIT -III

Congestion and Quality of Service: Data Traffic, Congestion, Congestion Control, Congestion Control in TCP, Congestion Control in Frame Relay, Source Based Congestion Avoidance, DEC Bit Scheme, Quality of Service, Techniques to Improve QOS: Scheduling, Traffic Shaping, Admission Control, Resource Reservation, Integrated Services and Differentiated Services.

UNIT - IV

Queue Management: Concepts of Buffer Management, Drop Tail, Drop Front, Random Drop, Passive Buffer Management Schemes, Drawbacks of PQM, Active Queue Management: Early Random Drop, RED Algorithm.

UNIT - V

Stream Control Transmission Protocol: SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control.

Mobile Network Layer: Entities and Terminology, IP Packet Delivery, Agents, Addressing, Agent Discovery, Registration, Tunneling and Encapsulating, Inefficiency in Mobile IP.

Mobile Transport Layer : Classical TCP Improvements, Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/Fast Recovery, Transmission, Timeout Freezing, Selective Retransmission, Transaction Oriented TCP.

TEXT BOOKS:

1. Behrouz A Forouzan, "TCP/IP Protocol Suite", TMH, 3rd Edition
2. B.A. Forouzan, "Data communication & Networking", TMH, 4th Edition.

REFERENCES:

1. Mahbub Hasan & Raj Jain, " High performance TCP/IP Networking", PHI -2005
2. Douglas. E.Comer, "Internetworking with TCP/IP ", Volume I PHI
3. Larry L. Perterson and Bruce S.Davie , "Computer Networks- A Systems Approach", 2011, Morgan Kaufmann
4. Jochen Schiiler, "Mobile Communications" , Pearson , 2nd Edition.

22CM6173: RANDOM PROCESSES AND QUEUING THEORY

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Probability Theory & Stochastic Processes

Course Objectives

The main objectives of the course are:

1. To explore in the random process and queuing theory useful for Computer and communication Networks.
2. Understand Random variables as an intrinsic need for the analysis of random phenomena.
3. To understand the modeling of telecommunication networks using appropriate queuing process.
4. To know the need of Markov chains and queuing theory in communication networks.

Course Outcomes

Studentswill be able to**:**

1. Evaluate and apply moments and Characteristics functions.
2. Understand the concept of random process spectral density of stationary process.
3. Understand the concepts of Markov Chains and queuing theory.
4. Understand the concepts of M| M|1, M|M|1|K, M|G|1 queuing Process.

UNIT I

Random Variable

Random Variables-Basic Definitions and properties, Sum of independent random variables, Minimum and Maximum of random variables, Comparisons between random variables, Moments of the random variables, Random variables in the field of telecommunications, Transformations of random variables- The probability generating function, the characteristic function of a pdf, The Laplace Transform of a pdf, Methods for the generation of random variables- Method of the inverse of the distribution function, Method of the transformation.

UNIT II

Random Processes

The Random Process Concept, Concept of Stationarity and Statistical Independence, First Order Stationary Processes, Second Order and Wide Sense Stationary, (N-Order) and Strict Sense Stationarity, Time Averages and Ergodicity, Mean Ergodic Processes, Correlation Ergodic Processes, Autocorrelation Function and its Properties, Cross Correlation function and its properties, Covariance Functions, The Power Spectrum- Properties, Relationship between Power spectrum and Autocorrelation function.

UNIT III

Markov Chains and Queuing Theory

Queues, Poisson arrival process- Sum of independent Poisson processes, Random splitting of a Poisson process, Compound Poisson processes, Birth death Markov chains, Formulation of Hidden Markov Model (HMM), building, evaluation and decoding of HMM, Notations for Queuing systems, The Little Theorem, M/M/1 queue analysis, M/M/1/K queue analysis, M/M/S queue analysis, M/M/S/S queue analysis, The M/M/∞ queue analysis, Distribution of the queuing delays in the FIFO case- M/M/1 case, M/M/S case.

UNIT IV

M/G/1 Queuing Theory

M/G/1 queue, M/G/1 system delay distribution in the FIFO case, Laplace Transform numerical inversion method, Generalizations of the M/G/1 theory, Different imbedding instants in the M/G/1 theory, M/G/1 with geometrically distributed messages.

UNIT V

Local Area Network Analysis

Introduction, Contention based protocols- Aloha, Slotted Aloha, Aloha Protocol with ideal capture effect, CSMA Schemes, Demand assignment protocols-Polling protocol, Token passing protocol, Analysis of token and polling Schemes, R-Aloha, PRMA protocol, Comparisons between CSMA/CD and Token Protocols, Fixed assignment Protocols- FDMA, TDMA, Resource reuse in cellular systems, CDMA.

TEXTBOOKS

1. Probability, Random Variables & Random Signal Principles-Peyton Z. Peebles, TMH, 4th Edition,2001.
2. Queuing Theory and Telecommunications Networks and Applications, Springer, Giovanni Giambene, 2014.

REFERENCES

1. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis, S. Unnikrishna Pillai – TMH, 2008
2. Probability and Random Processes with Applications to Signal Processing – Henry Stark, John W. Woods, 3rd Edition, Pearson, 2003
3. Probability and Stochastic Processes – A Friendly Introduction for Electrical and Computer Engineers – Roy D. Yates, David J. Goodman.2014
4. Digital Processing of Speech Signals. L.R Rabinar and R W Jhaung, 1978, PHI.

22CM6174: 5G COMMUNICATIONS

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Concepts of Wireless and Mobile Communications.

CourseObjectives:

This course aims to:

1. Understand the requirements & concepts of 5G.
2. Expose the architecture and radio access technologies of 5G.
3. Understand the device to device communication in 5G.
4. Learn the radio access technologies of 5G.
5. Learn Massive MIMO concepts.

Course Outcomes:

Upon completion of this course,students will be able to:

1. Recall the requirements and used cases of5Gtechnology.
2. Illustrate the architecture of 5G.
3. Apply the 5G concepts to D2D communications.
4. Compare various Radio-Access Technologies.
5. Explain the concept of massive MIMO.

UNIT –I

Overview of 5G: An Overview of 5G Requirements, 5G frequency bands: below 6GHz and above 6GHz, Spectrum Sharing for 5G: Introduction, Spectrum sharing scenario. Use cases and requirements: Autonomous vehicle control, Emergency communication, High-speed train, Shopping mall, Stadium, Smart city. 5G system concept: Extreme mobile broadband,Massive machine-type communication, Ultra-reliable Machine-type communication.

UNIT –II

5G Architecture: Introduction: NFV and SDN. Basics about RAN architecture, High-level requirements for the 5G architecture. Functional architecture and 5G flexibility: Functional split criteria, Functional split alternatives, Functional optimization for specific applications, Integration of LTE and new air interface to fulfill 5G requirements, Enhanced Multi-RAT coordination features. Physical architecture and 5G deployment: Deployment enablers, Flexible function placement in5Gdeployments.

UNIT-III

Device-to-Device (D2D) communications: D2D: from 4G to 5G.Radio resource management for mobile broadband D2D.Multi-hop D2D communications for proximity and emergency services. Multi-operatorD2Dcommunication.

UNIT -IV

5G Radio-Access Technologies: Access design principles for multi-user

communications,Multi-carrier with filtering:a new waveform, Non-orthogonal schemes for efficient multiple access: NOMA, SCMA & IDMA. Radio access for dense deployments, Radio access for V2X communication, Radio access for massive machine-type communication.

UNIT-V

Massive Multiple-Input Multiple-Output (MIMO) Systems: Introduction,Theoretical background:single user and multi-user MIMO,capacity of massive MIMO, Resource allocation and transceiver algorithms for massive MIMO, Fundamentals of baseband and RF implementations in massive MIMO.

Text Books:

1. Wei Xiang, Kan Zheng, Xuemin(Sherman) Shen, "5G Mobile Communications", Springer publications-2016.
2. Afif Osseiran, Jose F.Monserrat, Patrick Marsch,"5G Mobile and Wireless Communications Technology" Cambridge University Press-2016.

Suggested Reading:

1. Jonathan Rodriguez,"Fundamentalsof5GMobileNetworks"first edition,John Wiley&Sons,2015.
2. Saad Z. Asif,"5G Mobile Communications Concepts and Technologies" CRC Press, 2019.
3. Angeliki Alexiou,"5G Wireless Technologies", IET Publications, 2017.

22CM6175: CODING THEORY AND TECHNIQUES

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To acquire the knowledge in measurement of information and errors
2. Understand the importance of various codes for communication systems.
3. Able to design encoder and decoder of various codes.
4. To Analyze the applicability of source and channel codes.
5. To understand the decoding algorithms of various codes.

Course Outcomes: Upon completing this course, the student will be able to

1. Learn measurement of information and errors.
2. Obtain knowledge in designing various source codes and channel codes.
3. Design encoders and decoders for block and cyclic codes.
4. Obtain knowledge in designing various codes like turbo codes and ldpc codes.
5. Understand the significance of codes in various applications.

UNIT – I

Coding for Reliable Digital Transmission and storage: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies. Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT - II

Cyclic Codes : Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT – III

Convolutional Codes: Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT – IV

Turbo Codes: LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional

codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding.

UNIT - V

Space-Time Codes: Introduction, Digital modulation schemes, Diversity, Orthogonal space- Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing : General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation, Performance of Multi – Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

TEXT BOOKS:

1. Shu Lin, Daniel J. Costello, Jr, "Error Control Coding- Fundamentals and Applications", Prentice Hall, Inc.
2. Man Young Rhee, "Error Correcting Coding Theory", 1989, McGraw-Hill

REFERENCE BOOKS:

1. Bernard Sklar," Digital Communications-Fundamental and Application", PE.
2. John G. Proakis, "Digital Communications", 5th Edition, 2008, TMH.
3. Salvatore Gravano," Introduction to Error Control Codes", Oxford
4. Todd K. Moon, "Error Correction Coding – Mathematical Methods and Algorithms", 2006, Wiley India.
5. Ranjan Bose," Information Theory, Coding and Cryptography", 2nd Edition, 2009, TMH.

22CM6176 : SPREAD SPECTRUM COMMUNICATIONS

M.Tech. I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Knowledge of Digital Communications

Course Objectives

The objectives of this course are to make the student

1. Understand the concept of Spread Spectrum and study various types of Spread spectrum sequences and their generation.
2. Understand the principles of Code Division Multiple Access (CDMA) and use of Spread spectrum concept in CDMA
3. Understand various Code tracing loops for optimum tracking of wideband signals viz spread spectrum signals
4. Understand the procedure for synchronization of receiver for receiving the Spread spectrum signal.
5. To Analyze performance of spread spectrum systems in Jamming environment, systems with Forward Error Correction and Multiuser detection in CDMA cellular radio.

Course Outcomes

On completion of this course student will be able to

1. Generate various types of Spread spectrum sequences and can simulate CDMA system (Both Transmitter & Receiver).
2. Can develop algorithms for tracking of wideband signals.
3. Analyze different synchronization methods.

4.Can develop algorithms for detection and cancellation schemes for Multi-user's in CDMA cellular radio

5. Analyze the performance of Spread spectrum systems in Jamming environment and systems with Forward Error Correction.

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UNIT -I

Introduction to Spread Spectrum Systems Fundamental Concepts of Spread Spectrum Systems, Pseudo Noise Sequences, Direct Sequence Spread Spectrum, Frequency Hop Spread Spectrum, Hybrid Direct Sequence Frequency Hop Spread Spectrum, Code Division Multiple Access. Binary Shift Register Sequences for Spread Spectrum Systems Introduction, Definitions, Mathematical Background and Sequence Generator Fundamentals, Maximal Length Sequences, Gold Codes.

UNIT -II

Introduction to Code Tracking Loops, Optimum Tracking of Wideband Signals, Base Band Delay-Lock Tracking Loop, Tau-Dither Non- Coherent Tracking Loop, Double Dither Non-Coherent Tracking Loop.

UNIT -III

Initial Synchronization of the Receiver Spreading Code Introduction, Problem Definition and the Optimum Synchronizer, Serial Search Synchronization Techniques, Synchronization using a Matched Filter, Synchronization by Estimated the Received Spreading Code.

UNIT -IV

Cellular Code Division Multiple Access (CDMA) Principles Introduction, Wide Band Mobile Channel, The Cellular CDMA System, Single User Receiver in a Multi User Channel, CDMA System Capacity,
Multi-User Detection in CDMA Cellular Radio Optimal Multi-User Detection, Linear Sub optimal Detectors, Interference Combat Detection Schemes, Interference Cancellation Techniques.

UNIT -V

Performance of Spread Spectrum Systems in Jamming Environments Spread Spectrum Communication System Model, Performance of Spread Spectrum Systems without Coding. Performance of Spread Spectrum Systems with Forward Error Correction Elementary Block Coding Concepts, Optimum Decoding Rule, Calculation of Error Probability, Elementary Convolution Coding Concepts, Viterbi Algorithm, Decoding and Bit-Error Rate.

TEXT BOOKS

1. Rodger E Ziemer, Roger L. Peterson and David E Borth - "Introduction to Spread Spectrum Communication-Pearson, 1st Edition, 1995.
2. Mosa Ali Abu-Rgheff – "Introduction to CDMA Wireless Communications." Elsevier Publications, 2008.

REFERENCES

1. George R. Cooper, Clare D. Mc Gillem - "Modern Communication and Spread Spectrum," McGraw Hill, 1986.
2. Andrew j. Viterbi - "CDMA: Principles of spread spectrum communication," Pearson Education, 1st Edition, 1995.
3. Kamilo Feher - "Wireless Digital Communications," PHI, 2009.
4. Andrew Richardson - "WCDMA Design Handbook," Cambridge University Press, 2005.
5. Steve Lee - Spread Spectrum CDMA, McGraw Hill, 2002.

22CM6151: WIRELESS COMMUNICATIONS AND NETWORKS LAB

M.Tech. I Year I Sem.

L	T	P	C
0	0	4	2

Note:

- Minimum of 10 Experiments have to be conducted
- All the Experiments to be Conducted using Network Simulation software like NS-2/ NSG-2.1/ Wire SHARK/ SDR etc.

Note: For Experiments 1 to 7 Performance may be evaluated using the parameters Throughput, Packet Delivery Ratio, Delay etc.

1. Evaluate the performance of various LAN Topologies
2. Evaluate the performance of Drop Tail and RED queue management schemes
3. Evaluate the performance of CBQ and FQ Scheduling Mechanisms
4. Evaluate the performance of TCP and UDP Protocols
5. Evaluate the performance of TCP, New Reno and Vegas
6. Evaluate the performance of AODV, DSR and DSDV routing protocols
7. Evaluate the performance of IEEE 802.11 and IEEE 802.15.4
8. Capturing and Analysis of TCP and IP Packets
9. Simulation and Analysis of ICMP and IGMP Packets
10. Analyze the Protocols SCTP , ARP, NetBIOS, IPX VINES
11. Analysis of HTTP ,DNS and DHCP Protocols
12. Analysis of OFDM Spectrum
13. Analysis CDMA Downlink

22CM6152: PYTHON PROGRAMMING LAB

M.Tech. I Year I Sem.

L	T	P	C
0	0	4	2

Note: - Minimum of 10 experiments has to be conducted.

List of Programs:

1) a)Write a program to demonstrate different number data types in Python.

b)Write a program to perform different Arithmetic Operations on numbers in Python.

2) Write a program to create, concatenate and print a string and accessing sub-string from a given string.
3) Write a program to create, append, and remove lists in python.
4) Write a program to demonstrate working with tuples in python.
5) Write a python program to find factorial of a number using Recursion.
6) Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
7) Write a python program to linear regression
8) Write a python program to Multiple regression
9) Write a python program Networking and Interposes Communication
10) Write a python program for Non linear Equalization-Decision Feedback Equalization (DFE)
11) Write a python program for Maximum Likelihood Estimation (MLE) Equalizer
12) Write a python program for Algorithms for adaptive equalization-Zero Forcing Algorithm
13) Write a python program for Least Mean Square Algorithm
14) Write a python program for Recursive least squares algorithm

22MC6111: RESEARCH METHODOLOGY AND IPR

M.Tech. I Year I Sem.

L	T	P	C
2	0	0	2

Course Objectives:

1. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concepts, and creativity.
2. To follow research related information
3. Understand the role of IPR in the growth of industry in the contemporary world.

Course Outcomes: At the end of this course, students will be able to

1. To identify research problem from the real world.
2. To analyze research problem formulation in iterative process.
3. To explore IPR and Follow the Law accordingly.

UNIT I

Meaning of research problem, sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, approaches of investigation of solutions for research problem.

UNIT II

Data collection, analysis, interpretation, necessary instrumentations, Effective literature studies approaches, analysis Plagiarism, and Research ethics

UNIT III

Effective technical writing, how to write report, paper, Developing a research proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT IV

Nature of Intellectual property: Form of IPR: Patents, Designs, Trade, Copyright, Copy left, Creative Commence, IPR and Development - technological research, innovation, patenting, development, IPR Laws. International Scenario- International cooperation on intellectual property, Procedure for grants of patents.

UNIT V

Patents Rights: Scope of Patents Rights, Licensing and transfer of technology, Patents information and databases, Geographical Indications, New developments in IPR - IPR of Biological Systems, Computer Software etc., Case Studies: Barriers of IPR in case of traditional knowledge.

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: An introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research methodology: An introduction"
3. Ranjit Kumar, 2ND Edition, "Research methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age". 2016.
9. T. Ramappa, " Intellectual Property Rights Under WTO", S. Chand, 2008
10. https://www.gnu.org/
11. https://creativecommons.org/, GPL ver 2.0,30; CC by,CC By SA,CC by NC,CC by ND.

22CM6211 : ADVANCED COMMUNICATIONS AND NETWORKS

M.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives

The objectives of this course are to

1.Introduce basics of spread spectrum communication .

2.Introduce basics of OFDM, working principle.

3.Learn about the operation of MIMO systems, channel modeling ,coding.

4. introduce wireless LANs and its evolution.

5. introduce wireless PANs and wireless MANs its evolution

Course Outcomes

On completion of this course student will be able to

1.Understand the basics of spread spectrum communication .

2.Understand OFDM working principle and pulse shaping, windowing ,.

3. Understand MIMO systems, channel modeling ,coding.

4. Explain different types of LANs and their operation.

5.Explain different types of PANs and WANs their operation.

UNIT - I

Spread Spectrum Communications: Spreading sequences- Properties of Spreading Sequences, Pseudo- noise sequence, Gold sequences, Kasami sequences, Walsh Sequences, Orthogonal Variable Spreading Factor Sequences, Barker Sequence, Complementary Codes

Direct sequence spread spectrum: DS-CDMA Model, Conventional receiver, Rake Receiver, Synchronization in CDMA, Power Control, Soft handoff, Multiuser detection – Optimum multiuser detector, Liner multiuser detection.

UNIT - II

Orthogonal Frequency Division Multiplexing: Basic Principles of Orthogonality, Single vs Multicarrier Systems, OFDM Block Diagram and Its Explanation, OFDM Signal Mathematical Representation, Selection parameter for Modulation, Pulse shaping in OFDM Signal and Spectral Efficiency, Window in OFDM Signal and Spectrum, Synchronization in OFDM, Pilot Insert in OFDM Transmission and Channel Estimation, Amplitude Limitations in OFDM, FFT Point Selection Constraints in OFDM, CDMA vs OFDM, Hybrid OFDM.

UNIT - III

MIMO Systems: Introduction, Space Diversity and System Based on Space Diversity, Smart Antenna system and MIMO, MIMO Based System Architecture, MIMO Exploits Multipath, Space – Time Processing, Antenna Consideration for MIMO, MIMO Channel Modelling, MIMO Channel Measurement, MIMO Channel Capacity, Cyclic Delay Diversity (CDD), Space Time Coding, Advantages and Applications of MIMO in Present Context, MIMO Applications in 3G Wireless System and Beyond, MIMO-OFDM

UNIT - IV

Wireless LANs/IEEE 802.11x: Introduction to IEEE802.11x Technologies, Evolution of wireless LANs, IEEE 802.11 Design Issues, IEEE 802.11 Services, IEEE 802.11 MAC Layer operations, IEEE 802.11 Layer1, IEEE 802.11 a/b/g Higher Rate Standards, Wireless LAN Security, Computing Wireless Technologies, Typical WLAN Hardware

UNIT - V

Wireless PANs/IEEE 802.15x: Introduction to IEEE 802.15x Technologies: Wireless PAN Applications and Architecture, IEEE 802.15.1 Physical Layer Details, Bluetooth Link Controllers Basics, Bluetooth Link Controllers Operational States, IEEE 802.15.1 Protocols and Host Control Interface. Evaluation of IEEE 802.15 Standards BroadBand Wireless MANs/IEEE 802.16x: Introduction to WMAN/IEEE 802.16x Technology, IEEE 802.16Wireless MANs, IEEE 802.16 MAC Layer Details, IEEE 802.16 Physical Layer Details, IEEE 802.16 Physical Layer Details for 2-11 GHz, IEEE 802.16 Common System Operations.

TEXT BOOKS:

1. Gary J. Mullett, “Introduction to Wireless Telecommunications Systems and Networks”, CENGAGE
2. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009

REFERENCES:

1. Ke-Lin Du & M N S Swamy, “Wireless Communication System”, Cambridge University Press, 2010
2. Gottapu Sasibhusan Rao, “Mobile Cellular Communication”, PEARSON

22CM6212 : NETWORK SECURITY AND CRYPTOGRAPHY

M.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. To learn the fundamental principles of cryptography and its applications on the network security domain.
2. To learn various approaches to Encryption techniques, strengths of Traffic Confidentiality, Message Authentication Codes.
3. To learn cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel; verification of the authenticity of the source of a message
4. To learn about network level security and management mechanisms employing cryptography to prevent, detect, and mitigate security threats against the network
5. To learn system level security and management mechanisms employing cryptography to prevent, detect, and mitigate security threats against the network

Course Outcomes

The students will be able to

1. Understand the principles of cryptography as applicable to network security
2. Understand the cryptographic techniques that provide information and network security.
3. Understand the system and network security and Key management techniques.
4. Understand authentication protocols and digital signatures.
5. Develop the complete knowledge of network security and cryptography for secure Network

UNIT - I

Introduction: Attacks, Services, and Mechanisms, Security attacks, Security services, A Model for Internetwork security.

Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.

UNIT - II

Encryption Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block ciphers.

Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

UNIT - III

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

UNIT - IV

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC.

Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.Authenticationn Applications: Kerberos, X.509 directory Authentication service.

Electronic Mail Security: Pretty Good Privacy, S/MIME.

UNIT – V

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats. Fire Walls: Fire wall Design Principles, Trusted systems.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education.
2. William Stallings, "Network Security Essentials (Applications and Standards)", Pearson Education.

REFERENCE BOOKS:

1. Eric Maiwald, "Fundamentals of Network Security", Dreamtech Press
2. Charlie Kaufman, Radia Perlman and Mike Speciner," Network Security - Private Communication in a Public World", Pearson/PHI.
3. Whitman, "Principles of Information Security", Thomson.

22CM6271 : OPTICAL COMMUNICATIONS AND NETWORKS

M.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives

The objectives of this course are to make the student

1.Introduce the basics of signal propagation through optical fiber,**.**

2.understand fiber impairments, such as attenuation, dispersion and study about LASER

3.understand optical detectors and receiver operation.

4.understand receiver components and parameters

5.Introduce basic optical networks

Course Outcomes

On completion of this course student will be able to

1.Recognize and classify the structures of Optical fiber and types.

2.Discuss the channel impairments like losses and dispersion.

3.Analyze various coupling losses.

4.Explain Optical sources and detectors and to discuss their working principle.

5.Familiar with Design considerations of fiber optic system

UNIT-I

Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays. Electromagnetic Mode Theory of Optical Propagation - EM Waves - Modes in Planar Guide Cylindrical Fibers- Modes, V Number, Mode Coupling, Step Index Fibers, Graded Index Fibers. Single Mode Fibers- Cut off Wavelength, Mode Field Diameter, Effective Refractive Index

UNIT-II

Transmission Characteristics Of Optical Fiber -Attenuation - Material Losses absorption in silica glass fiber - Linear and Non Linear Scattering Losses - Fiber Bend unloading - Midband and far band infra red transmission - Intra and Inter-Modal Dispersion - All Over Fiber Dispersion - Polarization-non linear Phenomena. Optical fiber connectors, fiber alignment and Joint Losses - Fiber Splicer - Fiber Connectors - Expanded Beam Connectors - Fiber Couplers. Optical sources- LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Resonant frequencies. Reliability of LED & ILD.

UNIT-III

Optical Detectors- Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photodetectors. Optical receiver operation- Fundamental receiver

operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers.

UNIT-IV

Fiber Optic Receiver, Measurements - Fundamental Receiver Operation, Pre amplifiers, Error Sources - Receiver Configuration - Probability of Error - Quantum Limit. Fibre attenuation measurements, dispersion measurements - Fibre Refractive Index profile measurements - Fiber cut-off wave length Measurements - Fiber Numerical Aperture Measurements - Fiber diameter measurements.

UNIT-V

Optical Networks-Basic Networks-SONET/SDH-Broadcast-and –select WDM Networks-Wavelength Routed Networks –nonlinear effects on Network performance-Performance of WDM+EDFA system-solitons-Optical CDMA-Ultra High Capacity Networks.

TEXT BOOKS:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

RERFERENCES:

1. Rajiv Rama Swamy, "Optical Networks "Second Edition Elsevier 2004
2. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.
3. Text Book on Optical Fibre Communication and its Applications – S.C.Gupta, PHI, 2005.
4. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
5. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

22CM6272 : AD-HOC AND WIRELESS SENSOR NETWORKS

M.Tech. I Year II Sem. **L T P C**
3 0 0 3

Prerequisite: Knowledge of Wireless Sensor Networks

Course Objectives

The objectives of this course are to make the student
1. To learn the fundamentals of wireless Ad-Hoc Networks.
2. To learn the operation and performance of various Adhoc wireless network protocols.
3. To learn the architecture and protocols of Wireless sensor networks.
4. To learn Transport Layer Protocols of Wireless sensor networks
5. To learn the Sensor Network Architecture, data dissemination and data gathering.

Course Outcomes

On completion of this course student will be able to
1. Students will be able to understand the basis of Ad-hoc wireless networks.
2. Students will be able to understand design, operation and the performance of MAC layer protocols of Adhoc wireless networks.
3. Students will be able to understand design, operation and the performance of routing protocol of Adhoc wireless network.
4. Students will be able to understand design, operation and the performance of transport layer protocol of Adhoc wireless networks.
5. Students will be able to understand sensor network Architecture and will be able to distinguish between protocols used in Adhoc wireless network and wireless sensor networks.

UNIT - I

Wireless LANs and PANs: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.
AD HOC WIRELESS NETWORKS: Introduction, Issues in Ad Hoc Wireless Networks.

UNIT - II

MAC Protocols: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT - III

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

UNIT – IV

Transport Layer Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT – V

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

TEXT BOOKS

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control - Jagannathan Sarangapani, CRC Press.

REFERENCES

1. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh , 1st Ed. Pearson Education.
2. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer

22CM6273 : DETECTION AND ESTIMATION THEORY

M.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Knowledge of Probability Theory and Stochastic Processes

Course Objectives

The main objectives of the course are:

1. The main objective of this course is to provide basic estimation and detection background for engineering applications.
2. To learn about classifiers, hypotheses, filtering.
3. This course provides the main concepts and algorithms for detection and estimation theory.
4. Students learn the statistics and estimating the parameters of Random Process from detection.
5. To apply estimation methods for real time engineering problems.

Course Outcomes

On completion of this course student will be able to

1. Understand the basic Random Process and detection methods.
2. Known the significance of Probability of error
3. Learn about basic estimation methods and filters
4. Measure the statistical parameters for random processes
5. Estimate the auto correlation functions and power spectral density .

UNIT –I

Random Processes Discrete Linear Models, Markov Sequences and Processes, Point Processes, and Gaussian Processes.

UNIT –II

Detection Theory Basic Detection Problem, Maximum A posteriori Decision Rule, Minimum Probability of Error Classifier, Bayes Decision Rule, Multiple-Class Problem (Bayes)- minimum probability error with and without equal a priori probabilities, Neyman-Pearson Classifier, General Calculation of Probability of Error, General Gaussian Problem, Composite Hypotheses.

UNIT –III

Linear Minimum Mean-Square Error Filtering, Linear Minimum Mean Squared Error Estimators, Nonlinear Minimum Mean Squared Error Estimators. Innovations, Digital Wiener Filters with Stored Data, Real-time Digital Wiener Filters, Kalman Filters.

UNIT –IV

Statistics Measurements, Non parametric Estimators of Probability Distribution and Density Functions, Point Estimators of Parameters, Measures of the Quality of Estimators, Introduction to Interval Estimates, Distribution of Estimators, Tests of Hypotheses, Simple Linear Regression, Multiple Linear Regression.

UNIT –V

Estimating the Parameters of Random Processes from DataTests for Stationarity and Ergodicity, Model-free Estimation, Model-based Estimation of Autocorrelation Functions, Power Special Density Functions.

TEXT BOOKS

1. Random Signals: Detection, Estimation and Data Analysis – K. Sam Shanmugan & A.M. Breipohl, Wiley India Pvt. Ltd, 2011.
2. Random Processes: Filtering, Estimation and Detection – Lonnie C. Ludeman, Wiley India Pvt. Ltd., 2010.

REFERENCES

1. Fundamentals of Statistical Signal Processing: Volume I Estimation Theory– Steven.M.Kay, Prentice Hall, USA, 1998.
2. Introduction to Statistical Signal Processing with Applications – Srinath, Rajasekaran, Viswanathan, 2003, PHI.
3. Statistical Signal Processing: Detection, Estimation and Time Series Analysis – Louis L.Scharf, 1991, Addison Wesley.
4. Signal Processing: Discrete Spectral Analysis – Detection & Estimation – Mischa Schwartz, Leonard Shaw, 1975, Mc Graw Hill.

22CM6274: MACHINE LEARNING AND APPLICATIONS

M.Tech. I Year II Sem. **L T P C**
3 0 0 3

Prerequisite: Knowledge of Statistics and Linear Algebra

Course Objectives:

1. To understand the key algorithms and theory of Machine learning
2. To Understand the various Regression models
3. To Understand the Artificial Neural Networks
4. To Evaluate and interpret the results of the Hidden Markov Models and Bayesian Estimation
5. To Design and implement machine learning solutions to clustering problems

Course Outcomes: At the end of the course the student will be able to:

1: Understand the key algorithms and theory of Machine learning
2: Understand the Regression models
3: Understand the Artificial Neural Networks
4: Evaluate and interpret the results of the Hidden Markov Models and Bayesian Estimation
5: Design and implement machine learning solutions to clustering problems

UNIT I

Introduction, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Unsupervised Learning,Reinforcement Learning,
Learning a Class, Vapnik-Chervonenkis Dimension, Probably Approximately Correct Learning.

UNIT II:

Linear Regression, Multivariate Regression,Linear Methods for Regression,Linear Regression Models and Least Squares, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares, Linear Classification, Logistic Regression, and Linear Discriminant Analysis

UNIT III

Neural Networks Introduction, Early Models, Perceptron Learning, Back propagation, Initialization, Training & Validation, Parameter Estimation MLE, MAP, Bayesian Estimation

UNIT IV

Hidden Markov Models: Introduction, Discrete Markov Processes, Hidden Markov Models, Three Basic Problems of HMMs
Bayesian Estimation: Bayesian Estimation of the Parameters of a Discrete Distribution, Bayesian Estimation of the Parameters of a Gaussian Distribution.

Unit V

Clustering: Introduction, Mixture Densities, k-Means Clustering Partitional Clustering, Hierarchical Clustering, Birch Algorithm,Density-based Clustering,

Learning Theory, Introduction to Reinforcement Learning, Machine Learning: Real-World Examples-Image recognition.

TEXT BOOK:

1. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome H. Friedman Springer Series in Statistics, 2 edition, 2008.
2. Introduction to Machine Learning,Ethem Alpaydın, MIT Press 3 Edition,2014

REFERENCES:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education, 2013.
Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

22CM6275: HIGH PERFORMANCE NETWORKS

M.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Computer Networks, AWSN

Course Objectives

The main objectives of the course are:

1. To study about the services offered by communication networks.
2. To learn about issues and challenges in providing QoS in Ad-Hoc wireless networks.
3. To learn about QoS solutions of MAC and Network Layers.
4. Know the concepts of QoS Frame work for Ad-Hoc wireless networks
5. To learn the Next Generation Hybrid wireless networks

Course Outcomes

After completing this course the student will be able to:

1. Understand the features and services offered by communication networks.
2. Understand methods to improve QoS in networks.
3. Understand network and MAC layer solutions.
4. Acquire the knowledge about various QoS models, QoS solutions of MAC layer and Network layer
5. Analyze the features, architectures and functions of various Next generation Hybrid wireless networks.

UNIT I

Types of Networks, Network design issues, Data in support of network design. Network design tools, protocols and architecture. Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, and RSVP-differentiated services.

UNIT II

Quality of Service in Ad Hoc Wireless Network

Real-Time Traffic Support in Ad Hoc Wireless Networks, QoS Parameters in Ad Hoc Wireless Networks, Issues and Challenges In Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS solutions- Classifications of QoS Approaches, Layer-Wise Classification of Existing QoS Solutions,

MAC Layer Solutions- Cluster TDMA, IEEE802.11e, IEEE802.11 MAC Protocol - Distributed Coordination Function, Point Coordination Function, QoS Support Mechanisms of IEEE802.11e, Enhanced Distributed Coordination Function, Hybrid Coordination Function.

UNIT III

NETWORK LAYER SOLUTIONS

QoS Routing Protocols, Ticket-Based QoS Routing Protocol, Predictive Location-Based QoS Routing Protocol, Trigger-Based Distributed QoS Routing Protocol, QoS-Enabled Ad Hoc On-Demand Distance Vector Routing Protocol, Bandwidth Routing Protocol, On-Demand QoS Routing Protocol, On-Demand Link-State Multipath QoS Routing Protocol, Asynchronous Slot Allocation Strategies

UNIT IV

QoS frame work for Ad Hoc Wireless Networks

QoS Models-Flexible QoS Model for Mobile Ad Hoc Networks Advantages and Disadvantages
QoS Resource Reservation Signaling-MRSVP: A Resource Reservation Protocol for Cellular Networks, Limitations of Adapting MRSVP for Ad Hoc Wireless Networks.

INSIGNIA-Operation of INSIGNIA Framework, Releasing Resources in INSIGNIA, Route Maintenance, Advantages and Disadvantages, INORA- Coarse Feedback Scheme, Class-Based Fine Feedback Scheme, Advantages and Disadvantages.

SWAN-SWAN Model, Local Rate Control of Best-Effort Traffic, Source-Based Admission Control of Real-Time Traffic, Impact of Mobility and False Admission, Regulation Algorithms- Source-Based Regulation, Network-Based Regulation, Advantages and Disadvantages of SWAN.

UNIT V

Hybrid Wireless Networks

Introduction, Next-Generation Hybrid Wireless Architectures - Classification of Hybrid Architectures, The MCN Architecture, The MADF Architecture, The iCAR Architecture, The HWN Architecture, The SOPRANO Architecture, The MuPAC Architecture, The TWiLL Architecture, The A-GSM Architecture, The DWiLL Architecture, The UCAN Architecture, A Qualitative Comparison, Open Issues in the Next-Generation Hybrid Architectures, Routing In Hybrid Wireless Networks- Base-Assisted Ad Hoc Routing, Base-Driven Multi-Hop Bridging Routing Protocol, SMCN Routing Protocol, DWiLL Routing Protocol.

TEXTBOOKS

1. Ad Hoc Wireless Networks Architectures and Protocols C. Siva Ram Murthy B.S. Manoj, Prentice Hall, 6th Edition, 2008.
2. High-Performance Communication Networks - Warland J., Varaiya P., Morgan Kaufmann,1996.

REFERENCES

1. Ad Hoc and Sensor Networks Theory and Applications- Carols de Morais Cordeiro and Dharma prakash Agrawal, World Scientific
2. Wireless and Mobile Networks Concepts and Protocols- Dr. Sunil Kumar S. Manvi and Mahabaleshwar S. Kakkasageri.
3. Telecommunications Network Design Algorithms - KershenbaumA , Tata McGraw Hill,1993.

22CM6276: ADAPTIVE SIGNAL PROCESSING

M.Tech. I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisite: Digital Signal Processing

Course Objectives

The main objectives of the course are:

1. This course focuses on problems algorithms and solutions for processing signals in a manner that is responsive to a changing environment.
2. To develop systems on recursive, model based estimation methods taking the advantage of the statistical properties of the received signals.
3. To analyze the performance of adaptive filters and considers the application of the theory to a variety of practical problems such as beam forming and echo cancellation signal.
4. To understand innovation process, Kalman filter theory and estimation of state using the innovation process, concept of Kalman Gain and Filtering.

Course Outcomes

After studying the course, the student is expected to be able to :

1. Design and apply optimal minimum mean square estimators and in particular linear estimators.
2. Understand and compute their expected performance and verify it.
3. Design, implement and apply Wiener Filters (FIR, non-casual, causal) and evaluate their performance.
4. To understand innovation process, Kalman filter theory and estimation of state using the Innovation Process, concept of Kalman Gain and Filtering.
5. Design, implement and apply LMS, RLS and Kalman filters to given applications.

UNIT –I

Introduction to Adaptive Systems

Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner - Description, Weight Vectors, Desired Response Performance function - Gradient & Mean Square Error.

UNIT –II

Development of Adaptive Filter Theory & Searching the Performance surface

Introduction to Filtering - Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonally - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance - Minimum Mean Square Error.

UNIT –III

Steepest Descent Algorithms

Searching the performance surface – Methods & Ideas of Gradient Search methods - Gradient Searching Algorithm & its Solution - Stability & Rate of convergence - Learning Curves Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

UNIT –IV

LMS Algorithm & Applications

Overview - LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm.
Applications: Noise cancellation – Cancellation of echoes in long distance telephone circuits, Adaptive Beam forming.

UNIT –V
Kalman Filtering
Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Examples using Kalman filtering.

TEXT BOOKS

1. Adaptive Signal Processing - Bernard Widrow, Samuel D.Strearns, PE, 2005.
2. Adaptive Filter Theory - Simon Haykin-, 4th Ed., PE Asia 2002.

REFERENCES

1. Optimum signal processing: An introduction - Sophocles. J Orfamadis, 2 Ed., McGraw-Hill, New york, 1988.
2. Adaptive signal processing-Theory and Applications, S.Thomas Alexander, Springer –Verlag, 1986.
3. Signal analysis – Candy, Mc Graw Hill Int. Student Edition

James V. Candy, Signal Processing: A Modern Approach, McGraw-Hill, International Edition, 1988.

22CM6251: ADVANCED COMMUNICATIONS AND NETWORKS LAB

M.Tech. I Year II Sem.

L	T	P	C
0	0	4	2

Note:

I. Below experiments are to be performed using Matlab or equivalent software

1. Implementation of Matched Filters.
2. Optimum receiver for the AWGN channel.
3. Design FIR (LP/HP/BP) filter using Window method.
4. Measurement of effect of Inter Symbol Interference.
5. Generation of constant envelope PSK signal wave form for different values of M.
6. Simulation of PSK system with M=4
7. Simulation of DPSK system with M=4
8. Design of FSK system
9. Simulation of correlation type demodulation for FSK signal
10. BPSK Modulation and Demodulation techniques
11. QPSK Modulation and Demodulation techniques
12. DQPSK Modulation and Demodulation techniques
13. 8-QAM Modulation and Demodulation techniques
14. DQAM Modulation and Demodulation techniques
15. Verification of Decimation and Interpolation of a given signal
16. Power spectrum estimation using AR models

22CM6252 : NETWORK SECURITY AND CRYPTOGRAPHY LAB

M.Tech. I Year II Sem.

L	T	P	C
0	0	4	2

Note:

II. Below experiments are to be performed using C/C++/JAVA

III. Minimum 10 experiments are to be performed

1. Write a program to perform encryption and decryption using substitution and transposition cipher.
2. Write a program to implement DES algorithm logic
3. Write a program for evaluation of AES
4. Write a program for evaluation Triple DES
5. Write a program to implement Blowfish algorithm logic
6. Write a program to implement RSA algorithm logic
7. Implement Diffie-Hellman key exchange mechanism using html
8. Write a program to implement Euclid algorithm
9. Calculate the message digest of a text using SHA-1 algorithm
10. Implement the signature scheme digital signature standard
11. Implement electronic mail security
12. Case study on web security requirement

22CM7171: VOICE AND DATA NETWORKS

M.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course objectives:

The main objectives of the course are

1. To understand the various Issues in design of voice and data networks.
2. To study network design.
3. To understand various link layer protocols.
4. To develop queuing models of networks.
5. To learn.network extensions and next generation architectures

Course Outcomes: At the end of this course, students will be able to

1. Understand Protocol, algorithms, trade-offs rationale.
2. Gain the Knowledge about Routing, transport, DNS resolutions
3. Analyze and apply queuing models of networks.
4. Analyze Network extensions and next generation architectures.
5. Analyze quality of service in packet networks

Syllabus Contents:

Unit 1
Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Unit 2
Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Unit 3
Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Unit 4
Queuing Models of Networks , Traffic Models , Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks.

Unit 5
Inter-networking , Bridging, Global Internet , IP protocol and addressing , Sub netting , Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control , Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery: Congestion

avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

Text Books :

1. D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
2. L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach",5th Edition, Morgan Kaufman, 2011.

References

1. Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman, 2004.
2. Walrand,"Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
3. Leonard Kleinrock, "Queueing Systems,Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.

22CM7172 : IOT AND APPLICATIONS

M.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course objectives:

The main objectives of the course are:

1.To introduce the student to IOT and its applications.

2.To study M2M to IOT architecture overview..

3. Understand about IOT architecture

4. To explore the applications of IOT in industry .

5. To study various applications of IOT , related security and privacy

Course Outcomes:

At the end of this course, students will be able to

1. Understand the basic structure and scope of IOT.
2. Understand the concept of IOT and M2M
3. Gain knowledge about IOT architecture and applications in various fields
4. Analyze the security and privacy issues in IOT.
5. Explore the opportunities of IOT in different fields and carry out the design .

Unit 1

IoT& Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value
chain and global information monopolies. M2M to IoT - An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

Text Books

1. Vijay Madisetti and Arshdeep Bagha, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1stEdition, Apress Publications, 2013

Reference Books:

4. CunoPfisterr, “Getting Started with the Internet of Things”, OReilly Media, 2011.

22CM7173 : DEEP LEARNING

M.Tech. II Year I Sem. **L T P C**
3 0 0 3

Course Objectives:

1. Introduced to the basic concepts of neural networks.
2. To Identify and analyze the various types of neural networks and models of neuron and apply accordingly.
3. Introduce the concept of deep learning and its types.
4. Explore the concepts of applications of deep learning.
5. Introduce the concepts of sequential modeling , encoding and decoding.

Course Outcomes:
Upon completing this course students will be able to:

1. Analyze and apply the basic the concepts of neural networks
2. Analyze various types of neural networks and use various activation functions to solve complex problems.
3. Relate the concept of deep learning and its architecture.
4. Design and carry out empirical analysis for various types of applications of deep learning systems.
5. Model neural networks and apply encoding and decoding mechanism.

UNIT-I-

Introduction to Neural networks:Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units. Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of pattern storage Networks. Analysis of Pattern Mapping Networks.

UNIT – II-

Feedback Neural Networks:Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks. Competitive Learning Neural Networks & Complex pattern Recognition Introduction,Analysis of Pattern Clustering Networks, Analysis of Feature Mapping Networks, Associative Memory.

UNIT-III:

Fundamentals of Deep Learning: Defining Deep Learning, Common architectural principles of Deep Networks, Building Blocks of Deep Networks, and Major architectures of Deep Networks: Unsupervised Pretrained Networks, Convolution Neural Networks (CNNs), Recurrent Neural Networks.

UNIT-IV:

Convolution Neural Networks: The convolution operation, motivation, pooling, Convolution and Pooling as an Infinitely Strong Prior, Applications of deep learning: Large scale deep learning, Computer vision, Speech Recognition, Natural Processing, other applications.

UNIT V:

Sequential Modelling: Recurrent neural networks: Recursive neural networks,The long short –term Memory, explicit memory,Auto encoders:Under complete, regularised, Stochastic Encoders and Decoders,Denoising Auto encoders

TEXT BOOKS:

1. Artificial Neural Networks B. Yagna Narayana, PHI.(Chapter 1,2 and 3)
2. Deep Learning: A Practitioner's Approach by Josh Patterson, Adam Gibson.
3. Bengio, Yoshua, Ian J. Goodfellow and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015)-http://www.deeplearningbook.org/

REFERENCES:

1. Neural Networks by Simon Haykin PHI
2. Deep learning (Adaptive computation &Machine learning) by Ian GoodFellow,Yoshua Bengio, Aran Courville.
3. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, by Fausett.