WIRELESS COMMUNICATIONS AND NETWORKS

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6111 **3 0 0 3**

Course Objectives

The objectives of this course are to make the student

1. To study the Channel planning for Wireless Systems
2. To study the Mobile Radio Propagation
3. To study the Equalization and Diversity
4. To study the Wireless Networks

Course Outcomes:

At the end of this course, students will be able to
Understand Cellular communication concepts
Study the mobile radio propagation
Study the wireless network different type of MAC protocols

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-Ryce 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, Comparision 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 Pah Laven and P. Krishna Murthy, "Principles of Wireless Networks", 2002, PE
2. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson Education, 2012.
3. 2. William Stallings, "Wireless Communication and Networking", 2003, PHI.

ADVANCED DATA COMMUNICATIONS

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6112 **3 0 0 3**

Course Objectives

The main objectives of the course are:

1. To learn the basics of Data Communication networks, different protocols, standards and layering concepts.
2. To study about error detection and correction techniques.
3. To know about link layer, point to point, Medium Access and Control sub layer protocols.
4. To know about Switching circuits, Multiplexing and Spectrum Spreading techniques for data transmission.

Course Outcomes

At the end of the course, the student will be able to:

1. Understand the concepts of Networks and data link layer.
2. Acquire the knowledge of error detection, forward and reverse error correction techniques.
3. Compare the performance of different MAC protocols like Aloha, CSMA, CSMA/CA, TDMA, FDMA & CDMA.
4. Understand the significance of Switching circuits and characteristics of Wired LANs

UNIT I

Data Communications, Networks and Network Types, Internet History, Standards and Administration, Protocol Layering, TCP/IP protocol suite, OSI Model. Digital Data Transmission, DTE-DCE interface.

Data Link Layer

Introduction, Data Link Layer, Nodes and Links, Services, Categories of Links, sub layers, Link Layer Addressing, Address Resolution Protocol.

UNIT II

Error Detection and Correction Types of Errors, Redundancy, detection versus correction, Coding Block Coding: Error Detection, Vertical redundancy cheeks, longitudinal redundancy cheeks, Error Correction, Error correction single bit, Hamming code.

Cyclic Codes: Cyclic Redundancy Check, Polynomials, Cyclic Code Encoder Using Polynomials, Cyclic Code Analysis, Advantage of Cyclic Codes, Checksum

Data Link Control: DLC Services, Data Link Layer Protocols, HDLC, Point to Point Protocol

UNIT III

Media Access Control (MAC) Sub Layer

Random Access, ALOHA, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA),Controlled Access-Reservation, Polling- Token Passing, Channelization - Frequency Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA).

Wired LANS

Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Giga bit Ethernet

UNIT IV

Switching: Introduction to Switching, Circuit Switched Networks, Packet Switching, Structure of switch

Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing.

Spread Spectrum-Frequency Hopping Spread Spectrum and Direct Sequence Spread Spectrum

Connecting devices:Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.

UNIT V

Networks Layer: Packetizing, Routing and Forwarding, Packet Switching, Network Layer Performance, IPv4 Address, Address Space, Classful Addressing, Classless Addressing, Dynamic Host Configuration Protocol (DHCP), Network Address Resolution(NATF), Forwarding of IP Packets, Forwarding based on Destination Address, Forwarding based on Label, Routing as Packet Switches.

Unicast Routing :Introduction, Routing Algorithms-Distance Vector Routing, Link State Routing, Path Vector Routing, Unicast Routing Protocols- Routing Information Protocol(RIP), Open Short Path First .

TEXT BOOKS

1. Data Communications and Networking - B. A. Forouzan, 5th Ed., TMH, 2013.
2. Data and Computer Communications - William Stallings, 8th Ed., PHI, 2007.

REFERENCES

1. Data Communications and Computer Networks - Prakash C. Gupta, PHI, 2006.
2. Data Communications and Networking - B. A. Forouzan, 2nd Ed., TMH, 2013.
3. Data Communications and Computer Networks- Brijendra Singh, 2nd Ed., 2008.

COGNITIVE RADIO NETWORKS

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6171 **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 holedetection.
3. To study the models and techniques for efficient utilization of spectrum

Course Outcomes:

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

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

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 radionetworks.

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. EkramHossain, Dusit Niyato, Zhu Han, “Dynamic Spectrum Access and Management in Cognitive Radio Networks”, Cambridge University Press,2009. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive radio networks”, John Wiley & Sons Ltd.,2009.
2. Bruce Fette, “Cognitive radio technology”, Elsevier, 2nd edition,2009.

REFERENCE BOOKS:

1. HuseyinArslan, “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.

TCP/IP INTERNETWORKING

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6172 **3 0 0 3**

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, Connectionless 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.

DETECTION AND ESTIMATION THEORY

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6173 **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. This course provides the main concepts and algorithms for detection and estimation theory.
3. Students learn the statistics and estimating the parameters of Random Process from detection.
4. 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

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, Nonparametric 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 Data Tests 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.

4G TECHNOLOGIES

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6174 **3 0 0 3**

Prerequisite: Concepts of Wireless and Mobile Communications.

Course Objectives:

The objectives of the course 4G Technologies are

1. To learn the concepts of Second Generation, Third Generation Cellulartechnologies.
2. To study the Evolution Generation (2.5G) technologyplatforms.
3. To study various 4G technologies like OFDM, MC-CDMAetc.
4. TounderstandUWBwirelesschannels,channelmodellingformicro,picocells.

Course Outcomes:

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

1. Explain and compare Second and Third Generation technologies, their architectures.
2. Describe improved version of 2G technology i.e., evolution Generation(2.5G).
3. Define 4G technologies, their applications in modern wireless communication systems.
4. Evaluate the performance of OFDM system in fading environment.
5. Differentiatevarioushybridmultipleaccessschemesusedin4Gsystems.
6. Demonstrate the knowledge about UWB wireless channels.

UNIT – 1:

2Gtechnology:SecondGeneration(2G):Overview,Enhancementsover1GSystems, Integration with Existing 1G Systems, GSM, IS-136 System Description, IS-95 System Description, iDEN (Integrated Dispatch Enhanced Network),CDPD.

Third Generation (3G): Overview, Introduction, Universal Mobile Telecommunications Service(UMTS),UMTSServices,TheUMTSAirInterface,Overviewofthe3GPPRelease 1999 Network Architecture, Overview of the 3GPP Release 4 Network Architecture, Overviewofthe3GPPRelease5All-IPNetworkArchitecture,OverviewCDMA2000,TD- CDMA, TD-SCDMA, Commonality Between WCDMA, CDMA2000, TD-CDMA and TD- SCDMA.

UNIT – 2:

The Evolution Generation (2.5G): What Is 2.5G?, Enhancements over 2G, Technology Platforms, General Packet Radio Service, (GPRS), Enhanced Data Rates forGlobal Evolution (EDGE),High-Speed Circuit Switched Data (HSCSD), CDMA2000 (1XRTT),WAP,SMS,MigrationPathfrom2Gto2.5Gto3G.

UNIT – 3:

4G Technology: Fundamentals of 4G, Advantages and Applications of 4G, Technology path, IMS, Convergent Devices, Advanced Broadband Wireless Access, Multimedia (Mobile TV), Business Requirements.

OFDM: Timing and frequency offset in OFDM, Fading channel estimation for OFDM signals, Space-Time coding with OFDM signals, Layered Space-Time coding for MIMO OFDM, PAPR Reduction of OFDM signals.

UNIT – 4:

MC-CDMA : Signal Structure, Downlink Signal, Uplink Signal, Spreading Techniques, Detection Techniques, Pre- Equalization, Combined Equalization , Soft Channel Decoding Flexibility in System design, Performance Analysis, MC-DS-CDMA, Signal Structure, Downlink Signal, Uplink Signal,

Spreading, Detection Techniques, Performance Analysis.

Hybrid Multiple Access Schemes: Orthogonal Frequency Division Multiple Access (OFDMA), Single - Carrier FDMA (SC-FDMA), OFDMA with Code Division Multiplexing (SS-MC-MA).

UNIT – 5:

UWB: Ultra Wide Band Radio, The UWB channel, Coded UWB schemes, Multiuser detection in UWB radio, UWB with space–time processing.

ChannelModellingandMeasurementsfor4G:Macrocellularenvironments(1.8GHz), urban spatial radio channels in macro/microcell (2.154GHz), MIMO channels in microcell and picocellenvironments (1.71/2.05 GHz), Outdoor mobile channel (5.3 GHz), Microcell channel (8.45 GHz), Wireless MIMO LAN environments (5.2GHz).

TEXT BOOKS:

1. Clint Smith, P.E., Daniel Collins, "3G Wireless Networks", 2nd ed., McGraw-Hill, 2007.
2. Savo G. Glisic, "Advanced Wireless Communications: 4G Cognitive and Cooperative Broadband Technology", 2nd ed., University of Oulu, Finland, John Wiley & Sons,Ltd,2007.
3. K.Fazel, S.Kaiser, "Multi‐Carrier and Spread Spectrum Systems: From OFDM and MC‐CDMA to LTE and WiMAX", 2nd ed., John Wiley & Sons, Ltd,2008.

REFERENCE BOOKS:

1. UpenaDalal, "Wireless Communication", Oxford University Press,2009.
2. Simon R. Saunders, Alejandro Aragon-Zavala, "Antennas and Propagation for Wireless Communication Systems",2nded.,2008.

CODING THEORY AND TECHNIQUES

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6175 **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 design encoder and decoder of various codes.
4. To Analyze the applicability of source and channel 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. 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.

SPREAD SPECTRUM COMMUNICATIONS

M.Tech. I Year I Sem. **L T P C**
Course Code: 19CM6176 **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. Analyze the performance of Spread spectrum systems in Jamming environment and systems with Forward Error Correction.
3. Can develop algorithms for detection and cancellation schemes for Multi-user's in CDMA cellular radio.

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 Suboptimal 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.

WIRELESS COMMUNICATIONS AND NETWORKS LAB

M.Tech. I Year I Sem.	**L**	**T**	**P**	**C**
Course Code: 19CM6151	**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

ADVANCED DATA COMMUNICATIONS LAB

M.Tech. I Year I Sem.	L	T	P	C
Course Code: 19CM6152	0	0	4	2

Note:

A. Minimum of 10 Experiments have to be conducted

B. All Experiments to be Simulated using MATLAB and to be verified using related training kits.

1. Measurement of Bit Error Rate using Binary Data.
2. Verification of minimum distance in Hamming code.
3. Determination of output of Convolutional Encoder for a given sequence.
4. Determination of output of Convolutional Decoder for a given sequence.
5. Efficiency of DS Spread- Spectrum Technique.
6. Simulation of Frequency Hopping (FH) system.
7. Determination of Losses in Optical fiber.
8. Calculation of Numerical Aperture in Optical fibers.
9. Observing the waveforms at various test points of a mobile phone using Mobile Phone Trainer.
10. Study of direct sequence spread spectrum modulation and demodulation using CDMA-DSSS-BER trainer.
11. Characteristics of LASER diode.
12. Determination of parameters using global positioning system trainer.

Note:

A. Minimum of 10 Experiments have to be conducted

B. All Experiments to be Simulated using MATLAB or equivalent and to be verified using related training kits.

RESEARCH METHODOLOGY AND IPR

M.Tech. I Year I Sem.	L	T	P	C
Course Code:19MC6111	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
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ADVANCED COMMUNICATIONS AND NETWORKS

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM6211 **3 0 0 3**

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

Broad Band 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

NETWORK SECURITY AND CRYPTOGRAPHY

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM6212 **3 0 0 3**

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. Authentication 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:

[Type text]

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.

OPTICAL COMMUNICATIONS AND NETWORKS

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

Course Code: 19CM6271 **3 0 0 3**

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 farband 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, Comparision 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.

AD-HOC AND WIRELESS SENSOR NETWORKS

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM6272 **3 0 0 3**

Prerequisite: Knowledge of Wireless Sensor Networks

Course Objectives

The objectives of this course are to make the student
1. To study the fundamentals of wireless Ad-Hoc Networks.
2. To study the operation and performance of various Adhoc wireless network protocols.
3. To study the architecture and protocols of Wireless sensor networks.

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

WIRELESS MIMO COMMUNICATIONS

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM6273 **3 0 0 3**

UNIT - I

Fading Channels and Diversity Techniques: Wireless channels – Error/Outage probability over fading channels – Diversity techniques – Channel coding as a means of time diversity – Multiple antennas in wireless communications.

UNIT - II

Capacity and Information Rates of MIMO Channels: Capacity and Information rates of noisy, AWGN and fading channels – Capacity of MIMO channels – Capacity of non-coherent MIMO channels – Constrained signaling for MIMO communications.

UNIT - III

Space-Time Block and Trellis Codes: Transmit diversity with two antennas: The Alamouti scheme – Orthogonal. and Quasi-orthogonal space-time block codes – Linear dispersion codes – Generic space-time trellis codes – Basic space-time code design principles – Representation of space-time trellis codes for PSK constellation – Performance analysis for space-time trellis codes – Comparison of space-time block and trellis codes.

UNIT - IV

Concatenated Codes and Iterative Decoding: Development of concatenated codes – Concatenated codes for AWGN and MIMO channels – Turbo coded modulation for MIMO channels – Concatenated space-time block coding.

UNIT - V

Space-Time Coding for Frequency Selective Fading Channels: MIMO frequency-selective channels – Capacity and Information rates of MIMO FS fading channels.– Space-time coding and Channel detection for MIMO FS channels – MIMO OFDM systems.

TEXT BOOKS:

1. Tolga M. Duman and Ali Ghrayeb, *"*Coding for MIMO Communication systems", John Wiley & Sons, West Sussex, England, 2007.
2. A. B. Gershman and N.D. Sidiropoulus, "Space-time processing for MIMO Communications*",* Wiley, Hoboken, NJ, USA, 2005.

REFERENCES:

1. E.G. Larsson and P. Stoica, *"*Space-time block coding for Wireless communications", Cambridge University Press, 2003.
2. M. Janakiraman, "Space-time codes and MIMO systems*"*, Artech House, 2004.
3. H. Jafarkhani*, "*Space-time coding: Theory & Practice*"*, Cambridge University Press, 2005.

PATTERN RECOGNITION AND MACHINE LEARNING

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM6274 **3 0 0 3**

Prerequisite: Knowledge of Statistics and Linear Algebra

Course Objectives

1. The student will be able to understand the mathematical formulation of patterns.
2. To study the various linear models.
3. Understand the basic classifiers.
4. Can able to distinguish different models.

Course Outcomes

On completion of this course student will be able to

1. Learn the basics of pattern classes and functionality.
2. Construct the various linear models.
3. Understand the importance kernel methods.
4. Learn the Markov and Mixed models.

UNIT-I

Introduction to Pattern recognition:

Mathematical Formulation and Basic Functional Equation, Reduction of Dimensionality, Experiments in Pattern Classification, Backward Procedure for Both Feature Ordering- and Pattern Classification, Suboptimal Sequential Pattern Recognition , Nonparametric Design of Sequential Pattern Classifiers , Analysis of Optimal Performance and a Multiclass Generalization

UNIT-II

Linear Models:

Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive ,Equivalent , Bayesian Model Comparison, Probabilistic Generative Models-Continuous inputs , Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models -Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions

UNIT-III

Kernel Methods:

Constructing Kernels, Radial Basis Function Networks - Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression, Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines- Maximum Margin Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification

UNIT-IV

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Graphical Models:
Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, D-separation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

UNIT-V
Mixture Models and EM algorithm:
K-means Clustering-Image segmentation and compression, Mixtures of Gaussians-Maximum likelihood, EM for Gaussian mixtures, An Alternative View of EM- Gaussian mixtures revisited, Relation to K-means, Mixtures of Bernoulli distributions, EM for Bayesian linear regression, The EM Algorithm in General, Combining Models- Tree-based Models, Conditional Mixture Models- Mixtures of linear regression models, Mixtures of logistic models, Mixtures of experts.

TEXT BOOKS

1. Sequential methods in Pattern Recognition and Machine Learning-K.S.Fu, Academic Press, volume no.52.
2. Pattern Recognition and Machine Learning- C. Bishop-Springer,2006.

REFERENCES

1. Pattern Classification- Richard o. Duda, Peter E. hart, David G. Stork, John Wiley& Sons, 2nd Ed., 2001.
2. The elements of Statistical Learning- Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, Springer, 2nd Ed., 2009.

HIGH PERFORMANCE NETWORKS

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM6275 **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. Acquire the knowledge about various QoS models, QoS solutions of MAC layer and Network layer
4. 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 Appications- 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 - Kershenbaum A , Tata McGraw Hill,1993.

REMOTE SENSING

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

Course Code: 19CM6276 **3 0 0 3**

Course Outcomes:

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

1. Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles;
2. Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

Unit I: Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing Effects of Atmosphere-Scattering–Different types–Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Unit II: Data Acquisition: Types of Platforms–different types of aircrafts-Manned and Unmanned spacecrafts–sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT,SPOT,IRS,INSAT,IKONOS,QUICKBIRD etc

Unit III: Photographic products, B/W, color, color IR film and their characteristics –resolving power of lens and film -Opto mechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery -calibration of thermal scanners.

Unit IV: Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution – range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit V: Thermal And Hyper Spectral Remote Sensing: Sensors characteristics-principle of spectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing – thermal sensors, principles, thermal data processing, applications.: Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification– Principles of LiDAR, Aerial Laser Terrain Mapping.

Text Books :

1. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, John Wiley & Sons-2000, 6thEdition
2. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 2nd Edition, 1995.

Reference Books:

1. John A.Richards, Springer –Verlag, Remote Sensing Digital Image Analysis,1999.
2. Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.

ADVANCED COMMUNICATIONS AND NETWORKS LAB

M.Tech. I Year II Sem.	**L**	**T**	**P**	**C**
Course Code: 19CM6251	**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

NETWORK SECURITY AND CRYPTOGRAPHY LAB

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM6252 **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

VOICE AND DATA NETWORKS

M.Tech. II Year I Sem. **L T P C**
Course Code: 19CM7171 **3 0 0 3**

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 Network extensions and next generation architectures.

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.

IOT AND APPLICATIONS

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM7172 **3 0 0 3**

Course Outcomes:

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

1. Understand the concept of IOT and M2M
2. Gain knowledge about IOT architecture and applications in various fields
3. Analyze the security and privacy issues in IOT.

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 ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1stEdition, Apress Publications, 2013

Reference Books:

1. CunoPfister, “Getting Started with the Internet of Things”, OReilly Media, 2011.

DEEP LEARNING

M.Tech. I Year II Sem. **L T P C**
Course Code: 19CM7173 **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.

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.

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,DenoisingAuto 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.