ELECTIVES

**140CM9111 WIRELESS SYSTEMS AND STANDARDS 3 0 0 3**

**AIM:**

To make the students to gain knowledge in wireless systems and various standards adopted.

**OBJECTIVES:**

On completion of the course, the student will be able to:

- Know the need for standardization
- Classify the IrDA standards
- Understand the concepts of wireless systems
- Discuss the IEEE 802.11 standards
- Understand the characteristics of Ultra Wide Band technology

**UNIT I INTRODUCTION 8**

Introduction to Wireless Local Area Networks, The Need for standardization – Future Trends – The IrDA Standard – Introduction to IrDA: General Description – Physical Layer (SIR) – Serial Infrared Link Access Protocol (IrLAP)- IrDA Link Management Protocol (Ir-LMP)- IrDA Transport Protocol: Tiny TP-LAN. Access Extensions for Link Management Protocol: IrLAN.

**UNIT II WIRELESS SYSTEMS 8**

Advanced Mobile Phone Systems (AMPS) – Characteristics – Operation – General Working of AMPS Phone System – Global System for Mobile Communication – Frequency Bands and Channels – Frames – Identity Numbers – Layers, Planes and Interfaces of GSM – International Mobile Telecommunications (IMT-2000) – Spectrum Allocation – Services provided by 3G Cellular Systems – Harmonized 3G Systems – Universal Mobile Telecommunications Systems (UMTS)

**UNIT III THE IEEE 802.11 STANDARD 8**

Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) for the IEEE 802.11 Wireless LANs – Physical Layer for IEEE 802.11 Wireless LANs; Radio systems – Physical Layer for IEEE 802.11 Wireless LANs – IR Systems – Conclusions and Applications.

**UNIT IV THE HIPERLAN AND UPCOMING STANDARD 10**

Introduction - Terminology – Physical Layer - HIPERLAN Channel Access Control (CAC) – HIPERLAN Medium Access Control (MAC) – Conclusions on HIPERLAN Type 1 – Future Brand Standards. The Evolution of HIPERLAN – The Evolution of IEEE 802.11 – Forthcoming IR Standards

**UNIT V FUTURE TRENDS AND RECENT ADVANCES 11**

RF Standards: Digital Enhanced Cordless Technology (DECT) – Bluetooth – Wireless ATM (WATM) – Home RF. Introduction to Ultra Wide Band (UWB) Technology – Characteristics – Signal Propagation – Current Status and Applications – Advantages – Disadvantages – Challenges and Future Directions.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Assuncion Santamaria, Francisco Lopez-Hernandez, "Wireless LAN Standards and Applications", Artech House, 2001.
2. Dharma Prakash Agarwal and Qing- An zeng, "Introduction to Wireless and Mobile Systems", Vikas publishing House, New Delhi, 2004.
3. Neeli Prasad and Anand Prasad, "WLAN System & Wireless IP for Next Generation Communications", Artec House, 2002.


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BoS Chairman

**140CM9112** **WIRELESS SECURITY** **3 0 0 3**

**AIM:**

To introduce the student about the Various techniques and standards for communication network security and also introduces the system security for the Intruders.

**OBJECTIVES:**

- To study the Symmetric Ciphers techniques and Standards.
- To study the Public-Key encryption and Hash functions.
- To study the Network Security Practice and system security.

**UNIT I WIRELESS THREATS** **10**

Wireless Threats: Introduction to wireless technologies-Wireless data networks-Personal Area Networks --Kinds of security breaches- Eavesdropping-Communication Jamming - RF interference -Covert wireless channels –DOS attack - Spoofing-Theft of services-Traffic Analysis-Cryptographic threats-Wireless security Standards.

**UNIT II CRYPTOGRAPHY** **9**

Encryption and Decryption- Product ciphers-AES (advanced Encryption Standard)-Pseudorandom number Generator-Stream ciphers A5,RC4--Public key cryptography-ECC (Elliptic Curve Cryptography) - Cryptography in Embedded Hardware.

**UNIT III WIRELESS LOCAL AREA NETWORK (WLAN)** **9**

Introduction –Transmission Media-Securing WLANS-WLAN products and standard – Countermeasures-WEP (wired Equivalence Protocol)-Bluetooth security.

**UNIT IV SECURITY IN WIREELSS DATA NETWORKS** **9**

Wireless Device security issues - CDPD security (Cellular Digital Packet Data)-GPRS security (General Packet Radio Service)-GSM (Global System for Mobile Communication) security –IP-security.

**UNIT V WIRELESS TRANSPORT LAYER SECURITY (WTLS)** **8**

Secure Socket Layer-Wireless Transport Layer Security-WAP Security Architecture-WAP Gateway.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Merritt Maxim and David Pollino, "Wireless Security", Osborne/McGraw Hill , 2002.
2. Nichols and Lekka, "Wireless Security-Models, Threats and Solutions", McGraw – Hill, 2002.
3. William Stallings, "Cryptography and Network Security ,Principles and practices, Prentice Hall of India, 4th Edition, 2006.


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BoS Chairman

## 140CM9113 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING 3 0 0 3

**AIM:**

To introduce the students with the fundamentals of Programmable DSPs and various Processors architecture and Programming skills.

**OBJECTIVES:**

- To study the fundamentals of Programmable DSPs.
- To Study the TMS320C5X and TMS320C3X processors architecture and programming.

**UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9**

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressing modes in P-DSPs – On chip Peripherals.

**UNIT II TMS320C5X PROCESSOR 9**

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

**UNIT III TMS320C3X PROCESSOR 9**

Architecture – Data formats - Addressing modes – Groups of addressing modes - Instruction sets - Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals – Generating and finding the sum of series, Convolution of two sequences, Filter design

**UNIT IV ADSP PROCESSORS 9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

**UNIT V ADVANCED PROCESSOR 9**

Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Venkataramani. B. and Bhaskar. M., "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. User guides Texas Instrumentation, Analog Devices, Motorola.


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BoS Chairman

**140CM9114 DIGITAL SPEECH SIGNAL PROCESSING 3 0 0 3**

**AIM:**

To learn the mechanics of Speech and study the time domain and frequency domain methods for analysis and processing of speech signals.

**OBJECTIVES:**

- To study the fundamental mechanics of speech production and the nature of the speech signals.
- To study the time domain and frequency domain methods for speech processing.
- To study the Predictive analysis of speech an the algorithm for estimation and detection.

**UNIT I MECHANICS OF SPEECH 8**

Speech production mechanism – Nature of Speech signal – Discrete time modelling of Speech production – Representation of Speech signals – Classification of Speech sounds – Phones – Phonemes – Phonetic and Phonemic alphabets – Articulatory features. Music production – Auditory perception – Anatomical pathways from the ear to the perception of sound – Peripheral auditory system – Psycho acoustics

**UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING 8**

Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function

**UNIT III FREQUENCY DOMAIN METHOD FOR SPEECH PROCESSING 9**

Short Time Fourier analysis – Filter bank analysis – Formant extraction – Pitch Extraction – Analysis by Synthesis- Analysis synthesis systems- Phase vocoder— Channel Vocoder. HOMOMORPHIC SPEECH ANALYSIS: Cepstral analysis of Speech – Formant and Pitch Estimation – Homomorphic Vocoders.

**UNIT IV LINEAR PREDICTIVE ANALYSIS OF SPEECH 10**

Formulation of Linear Prediction problem in Time Domain – Basic Principle – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – lattice formation and solutions – Comparison of different methods – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP.

**UNIT V APPLICATION OF SPEECH SIGNAL PROCESSING 10**

Algorithms: Spectral Estimation, dynamic time warping, hidden Markov model – Music analysis – Pitch Detection – Feature analysis for recognition –Automatic Speech Recognition – Feature Extraction for ASR – Deterministic sequence recognition – Statistical Sequence recognition – ASR systems – Speaker identification and verification – Voice response system – Speech Synthesis: Text to speech, voice over IP.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc. , Singapore, 2004
2. Rabiner. L.R. and Schaffer. R.W., "Digital Processing of Speech signals" ,Prentice Hall ,1978
3. Quatieri ,"Discrete-time Speech Signal Processing" ,Prentice Hall , 2001.
4. Flanagan. J.L., "Speech analysis: Synthesis and Perception" , 2nd edition , Berlin , 1972
5. Witten. I.H. ,Principles of Computer Speech , Academic Press ,1982


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BoS Chairman

**140CM9115 NETWORK ROUTING ALGORITHMS 3 0 0 3**

**AIM:**
To make the students to understand, simulate and design network routing algorithms.

**OBJECTIVES:**
On completion of the course, the student will be able to:

- Understand the concepts of OSI layer
- Know different types of routing methods
- Discuss the types of internet routing methods
- Classify the RWA algorithm
- Compare routing algorithms of ad hoc network

**UNIT I INTRODUCTION 7**

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

**UNIT II INTERNET ROUTING 10**

Interior protocol : Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

**UNIT III ROUTING IN OPTICAL WDM NETWORKS 10**

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting- Benefits and Issues, Light path Migration, Rerouting Schemes, Algorithms- AG, MWPG.

**UNIT IV MOBILE - IP NETWORKS 9**

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based : Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

**UNIT V MOBILE AD –HOC NETWORKS 9**

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms – Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV), Hybrid Routing: Zone Based Routing (ZRP).

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. William Stallings, "High speed networks and Internets Performance and Quality of Service", 2nd Edition, Pearson Education Asia. Reprint India 2002
2. Steen Strub. M., "Routing in Communication network", Prentice ,Hall International, Newyork,1995.
3. Keshav. S., "An engineering approach to computer networking", Addison Wesley 1999.
4. William Stallings, "High speed Networks TCP/IP and ATM Design Principles", Prentice- Hall, New York, 1995
5. Perkins. C.E., "Ad Hoc Networking", Addison , Wesley, 2001
6. Ian F. Akyildiz, Jiang Xie and Shantidev Mohanty, "A Survey of mobility Management in Next generation All IP- Based Wireless Systems", IEEE Wireless Communications Aug.2004, pp 16-27.
7. Campbell et al. A.T., "Comparison of IP Micromobility Protocols", IEEE Wireless Communications Feb.2002, pp 72-82.
8. Siva Rama Murthy. C. and Mohan Gurusamy, "WDM Optical Networks, Concepts, Design and Algorithms", Prentice Hall of India Pvt. Ltd, New Delhi, 2002.


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BoS Chairman

**140CM9116** **GLOBAL POSITIONING SYSTEMS** **3 0 0 3**

**AIM:**

To make the student to understand the principles of Global Positioning systems and its Interdisciplinary applications.

**OBJECTIVES:**

- To study the History of GPS and its various segments.
- To study the co-ordinate system for the GPS systems.
- To study the navigational aids and signal processing for GPS systems.
- To study the propagation media for the GPS.
- To learn the Inter disciplinary applications for GPS.

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

History of GPS – BC-4 System – HIRAN – NNSS – NAVSTAR GLONASS and GNSS Systems – GPS Constellation – Space Segment – Control Segment – User Segment – Single and Dual Frequency – Point – Relative – Differential GPS – Static and Kinematic Positioning – 2D and 3D – reporting Anti Spoofing (AS); Selective Availability (SA) – DOP Factors.

**UNIT II COORDINATE AND TIME SYSTEM** **9**

Coordinate Systems – Geo Centric Coordinate System – Conventional Terrestrial Reference System – Orbit Description – Keplerian Orbit – Kepler Elements – Satellite Visibility – Topocentric Motion – Disturbed Satellite Motion – Perturbed Motion – Disturbing Accelerations - Perturbed Orbit – Time Systems – Astronomical Time System – Atomic Time – GPS Time – Need for Coordination – Link to Earth Rotation – Time and Earth Motion Services.

**UNIT III CODES AND RANGES** **9**

C/A code; P-code; Y-code; L1, L2 Carrier frequencies – Code Pseudo Ranges – Carries Phases – Pseudo Ranges – Satellite Signal Signature – Navigation Messages and Formats – Undifferenced and Differenced Range Models – Delta Ranges – Signal Processing and Processing Techniques – Tracking Networks – Ephemerides – Data Combination: Narrow Lane; Wide Lane – OTF Ambiguity.

**UNIT IV PROPAGATION MEDIA** **9**

Propagation Media – Multipath – Antenna Phase Centre – Atmosphere in brief – Elements of Wave Propagation – Ionospheric Effects on GPS Observations – Code Delay – Phase Advances – Integer Bias – Clock Error – Cycle Slip – Noise-Bias – Blunders – Tropospheric Effects on GPS Oberservables – Multipath Effect – Antenna Phase Centre Problems and Correction.

**UNIT V APPLICATIONS** **9**

Inter Disciplinary Applications – Crystal Dynamics – Gravity Field Mapping – Atmospheric Occulation – Surveying – Geophysics – Air borne GPS – Ground Transportation – Space borne GPS – Metrological and Climate Research using GPS.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Hoffman. B. - Wellenhof, H.Lichtenegger and J.Collins, "GPS: Theory and Practice", 4th revised edition, Springer, Wein, New york,1997
2. Leick. A., "GPS Satellites Surveying", 2nd edition, John Wiley & Sons,NewYork,1995
3. Parkinson. B., J.Spilker, Jr.(Eds), "GPS: Theory and Applications", Vol.I & Vol.II, AIAA, 370 L'Enfant Promenade SW, Washington, DC 20024, 1996
4. Kleusberg. A. and P.Teunisen(Eds), "GPS for Geodesy", Springer-Verlag, Berlin,1996
5. Adams. L., "The GPS - A Shared National Asset", Chair, National Academy Press, Washington, DC, 1995


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BoS Chairman

**140CM9117 WIRELESS ADHOC NETWORKS 3 0 0 3**

**AIM:**
To familiarize the students with the concepts of wireless communication technology and different types of protocols used.

**OBJECTIVES:**
On completion of the course, the student will be able to:

- Know the fundamentals of wireless communication technologies
- Classify different types of MAC protocols
- Designing of routing protocols for ad hoc network
- Understand the concepts of Multicast routing
- Classify QoS solutions
- Classify energy management schemes

**UNIT I MAC PROTOCOLS 10**

Fundamentals of Wireless Communication Technology, Characteristics of the Wireless Channel, Modulation Techniques, Multiple Access Techniques, Networking Standards, Wireless Networks, Mobile IP, Ad Hoc Wireless Networks. Designing a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols - Contention-Based, Contention-Based with Reservation Mechanisms, Contention-Based with Scheduling Mechanisms, MAC Protocols that use Directional Antennas

**UNIT II ROUTING PROTOCOLS AND MULTICAST ROUTING 12**

Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols -Table-Driven, On-Demand, Hybrid, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical, Power-Aware Routing Protocols. Designing a Multicast Routing Protocol - Operation of Multicast Routing Protocols, Classifications of Multicast Routing Protocols - Tree-Based, Mesh-Based, Energy - Efficient.

**UNIT III TRANSPORT LAYER AND SECURITY PROTOCOLS 8**

Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solution, TCP over Ad Hoc Wireless networks- Security in Ad Hoc Wireless Networks, Network Security Requirements. Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Network

**UNIT IV QUALITY OF SERVICE 5**

QoS in Ad Hoc Wireless Networks, Classifications of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks.

**UNIT V ENERGY MANAGEMENT AND ADVANCES IN WIRELESS NETWORK 10**

Energy Management in Ad Hoc Wireless Networks, Classification of Energy Management Schemes – Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes. Ultra-wide-band radio communication, Wireless fidelity systems, Optical wireless networks, Multimode 802.11 - IEEE 802.11a/b/g, wireless AD Hoc sensor Networks.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Siva Ram Murthy C. and Manoj B S, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall, June 2004.
2. Charles E Perkins, "Ad Hoc Networking", Addison-Wesley, 2001.
3. Toh C K, "Ad Hoc Mobile Wireless Networks: Protocols and Systems", Prentice Hall, 2001.
4. Mohammad Ilyas, "The Handbook of Ad Hoc Wireless Networks", CRC Press, 2002.
5. Basagni S, Marco Conti, Silvia Giordano, Ivan Stojmenovi and Cacute, "Mobile Ad Hoc Networking", John Wiley and Sons, 2004.


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BoS Chairman

**140CM9118** **SOFT COMPUTING** **3 0 0 3**

**(Common to CP and CM Programmes)**

**AIM:**

To provide a conceptual understanding of various Soft Computing techniques such as Genetic Algorithms, Neural Networks, Fuzzy Systems and Neuro-Fuzzy hybrid systems.

**OBJECTIVES:**

- To introduce the concept of Soft Computing
- To impart knowledge on the working principles and applications of Genetic Algorithms
- To develop an understanding of Neural Network architectures and their functioning
- To provide an overview of Fuzzy Logic and Fuzzy Systems
- To outline aspects related to design of hybrid Neuro-Fuzzy systems

**UNIT I INTRODUCTION TO SOFT COMPUTING** **8+3**

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

**UNIT II GENETIC ALGORITHMS** **10+3**

Introduction – Biological Background – Operators and Techniques in GA – Classification of GA – Applications.

**UNIT III NEURAL NETWORKS** **9+3**

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

**UNIT IV FUZZY LOGIC** **9+3**

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

**UNIT V NEURO-FUZZY MODELING** **9+3**

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

**L: 45, T: 15, Total: 60**

**REFERENCE BOOKS:**


1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley, 2010
3. Simon Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2009
4. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
5. Sivanandam. S.N., Deepa .S.N., " Introduction to Genetic Algorithms", Springer, 2008.
6. Rajasekaran. S., Vijayalakshmi Pai.G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", PHI Learning Pvt. Ltd., 2004.


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BoS Chairman

**140CM9119 DIGITAL COMMUNICATION RECEIVERS 3 0 0 3**

**AIM:**

To review the Digital communication techniques to the student and expose with the optimum receiver design for the noise perturbed channels.

**OBJECTIVES:**

- To review the digital communication techniques for the optimum receiver design for AWGN channels and Fading channels
- To study the synchronization techniques and adaptive equalization techniques in the receiver design.

**UNIT I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9**

Base band and band pass communication; signal space representation, linear and nonlinear modulation techniques, and Spectral characteristics of digital modulation

**UNIT II OPTIMUM RECEIVERS FOR AWGN CHANNEL 9**

Correlation demodulator, matched filter , maximum likelihood sequence detector, optimum receiver for CPM signals, M-ary orthogonal signals, envelope detectors for Mary and correlated binary signals

**UNIT III RECEIVERS FOR FADING CHANNELS 9**

Characterization of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, coded waveform for fading channel.

**UNIT IV SYNCHRONIZATION TECHNIQUES 9**

Carrier and signal synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

**UNIT V ADAPTIVE EQUALIZATION 9**

Zero forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalization of Trellis-coded signals. Kalman algorithm, blind equalizers and stochastic gradient algorithm.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Heinrich Meyer, Mare Moeneclacy, Stefan.A.Fechtel, " Digital communication receivers ",Vol I & Vol II, John Wiley, New York, 1997.
2. John.G.Proakis, "Digital communication", 4th Edition, McGraw-Hill, New York, 2001.
3. E.A.Lee and D.G. Messerschmitt, "Digital communication", 2nd Edition, Allied Publishers, New Delhi, 1994.
4. Simon Marvin, "Digital communication over fading channel; An unified approach to performance Analysis ", John Wiley, New York, 2000.
5. Herbert Taub, Donald L Schilling,Goutam Saha,"Principles of Communication Systems",3rd edition,TMH,New Delhi-2010


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BoS Chairman

**140CM9120** **WAVELETS AND SUBBAND CODING** **3 0 0 3**

**AIM:**

To introduce the students with the fundamental mathematics behind the wavelets and multiresolution processing.

**OBJECTIVES:**

- To study the mathematical background for the wavelets.
- To study the Multiresolution Analysis.
- To study the Continuous and Discrete wavelet transforms.

**UNIT I FOURIER ANALYSIS** **9**

Signal spaces - concept of Convergence - Hilbert spaces for energy signals. Fourier basis & Fourier Transform – failure of Fourier Transform – Need for Time-Frequency Analysis, Spectrogram plot - Phase-Space plot in Time-Frequency plane, Time and Frequency Limitations, Tiling of the Time-Frequency Plane for STFT – Heisenberg's Uncertainty principle – Short time Fourier transform (STFT) Analysis-short comings of STFT- Need for Wavelets.

**UNIT II CONTINUOUS WAVELET TRANSFORM (CWT) AND MULTIRESOLUTION ANALYSIS(MRA)** **9**

Wavelet basis – concept of scale and its relation with frequency, Continuous time Wavelet Transform equation – series expansion using wavelets – CWT – need for scaling function – Multi-Resolution Analysis (MRA) – Tiling of time-scale plane for CWT. Important wavelets: Haar, Mexican hat, Meyer, Shannon, Daubechies.

**UNIT III MULTIRATE SYSTEMS, FILTER BANKS AND DISCRETE WAVELET TRANSFORM (DWT)** **12**

Decimation and Interpolation in Time domain - Decimation and Interpolation in Frequency domain – Multi rate systems for a rational factor, Two channel filter bank – Perfect Reconstruction (PR) condition – relationship between filter banks and wavelet basis – DWT – Filter banks for Daubechies wavelet function.

**UNIT IV SPECIAL TOPICS** **9**

Wavelet packet transform Multidimensional wavelets, Bi-orthogonal basis-B-Splines, Lifting scheme of wavelet generation, Multiwavelets

**UNIT V APPLICATIONS OF WAVELETS** **6**

Signal Denoising - Sub-band coding of Speech and music– Image Compression using 2-D DWT- Fractal Signal Analysis.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Jaideva C Goswami and Andrew K Chan, "Fundamentals of Wavelets – Theory, Algorithms and Applications", John Wiley and Sons, Inc., Singapore, 1999.
2. Soman K P and Ramachandran K I, "Insight into Wavelets from Theory to Practice", Prentice Hall India, 1st Edition, 2004.
3. Vetterli M, and Kovacevic J, "Wavelets and Subband Coding," Prentice Hall, 1995.
4. Fliege. N J, "Multirate Digital Signal Processing", John Wiley and Sons, Newyork,1994.
5. Stephane G Mallat, "A Wavelet Tour of Signal Processing", Academic Press, 2nd Edition, 1999.
6. Wornell G W, "Signal Processing with Fractals: A Wavelet based Approach", Prentice Hall, 1995.


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BoS Chairman

**140CM9121** **VLSI SIGNAL PROCESSING** **3 0 0 3**

**(Common to AE and CM Programmes)**

**AIM:**

To enhance knowledge in VLSI design and signal processing.

**OBJECTIVES:**

- To introduce DSP systems, filters & processing.
- To emphases on retiming, parallel filters.
- To exposure on convolution methods & HR filters.
- To discussion about Bit–level arithmetic architectures, Lyon's bit serial multipliers.
- To get an idea about sub expression elimination, wave pipelining.

**UNIT I INTRODUCTION TO DSP SYSTEMS, PIPELINING AND PARALLEL PROCESSING OF FIR FILTERS** **9**

Introduction to DSP systems – Typical DSP algorithms, Data flow and Dependence graphs – critical path, Loop bound, iteration bound, Longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power.

**UNIT II RETIMING, ALGORITHMIC STRENGTH REDUCTION** **9**

Retiming – definitions and properties, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application, Algorithmic strength reduction in filters and transforms – 2–parallel FIR filter, 2–parallel fast FIR filter, DCT architecture, rank–order filters, Odd–Even merge–sort architecture, parallel rank–order filters.

**UNIT III FAST CONVOLUTION, PIPELINING AND PARALLEL PROCESSING OF IIR FILTERS 9**

Fast convolution – Cook –Toom algorithm, modified Cook – Toom algorithm, Pipelined and parallel recursive filters – Look–Ahead pipelining in first–order IIR filters, Look – Ahead pipelining with power of 2 decomposition, Clustered look – ahead pipelining, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters.

**UNIT IV SCALING, ROUND–OFF NOISE, BIT–LEVEL ARITHMETIC ARCHITECTURES** **9**

Scaling and round-off noise – scaling operation, round-off noise, state variable description of digital filters, scaling and round-off noise computation, round-off noise in pipelined IIR filters, Bit-level arithmetic architectures – parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon's bit–serial multipliers using Horner's rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement, Distributed Arithmetic fundamentals and FIR filters

**UNIT V NUMERICAL STRENGTH REDUCTION, SYNCHRONOUS, WAVE AND ASYNCHRONOUS PIPELINING** **9**

Numerical strength reduction – sub expression elimination, multiple constant multiplication, iterative matching, synchronous pipelining and clocking styles, clock skew in edge – triggered single phase clocking, two – phase clocking, wave pipelining. Asynchronous pipelining bundled data versus dual rail protocol.

**L: 45, T: 0, Total 45**

**REFERENCES:**


1. Keshab K. Parhi, " VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007.
2. Meyer. U – Baese, " Digital Signal Processing with Field Programmable Gate Arrays", Springer, 2nd Edition, 2004.


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BoS Chairman

**140CM9122 HIGH PERFORMANCE COMPUTER NETWORKS 3 0 0 3**

**AIM:**
To learn the advanced concepts of HPCN.

**OBJECTIVES:**
- To study the OSI and IP Models for packet switched networks
- To study the ISDN and BISDN architecture and protocols
- To learn about performance and Modeling
- To learn about threats in network security and Management

**UNIT I INTRODUCTION** **9**
Review of OSI, TCP/IP; Multiplexing, Modes of Communication, Switching, Routing. SONET – DWDM – DSL – ISDN – BISDN, ATM.

**UNIT II MULTIMEDIA NETWORKING APPLICATIONS** **9**
Streaming stored Audio and Video – Best effort service – protocols for real time interactive applications – Beyond best effort – scheduling and policing mechanism – integrated services – RSVP- differentiated services.

**UNIT III ADVANCED NETWORKS CONCEPTS** **9**
VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN.MPLSoperation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

**UNIT IV TRAFFIC MODELLING** **8**
Little's theorem, Need for modeling , Poisson modeling and its failure, Non- poisson models, Network performance evaluation.

**UNIT V NETWORK SECURITY AND MANAGEMENT** **10**
Principles of cryptography – Authentication – integrity – key distribution and certification – Access control and: fire walls – attacks and counter measures – security in many layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1

**L: 45, T: 0, Total: 45**

**REFERENCES:**

1. Kurose. J.F. & Ross. K.W., "Computer Networking- A top down approach featuring the internet", Pearson, 2nd Edition, 2003.
2. Walrand .J. Varatya, "High performance communication network", Morgan Kauffman – Harcourt Asia Pvt. Ltd. 2nd Edition, 2000.
3. LEOM-GarCIA, WIDJAJA, "Communication networks", TMH 7th reprint 2002.
4. Aunurag kumar, D. MAnjunath, Joy kuri, "Communication Networking", Morgan Kaufmann Publishers, 1st Edition 2004.
5. Hersent Gurle & petit, "IP Telephony, packet Pored Multimedia communication Systems", Pearson Education 2003.
6. Fred Halsall and Lingana Gouda Kulkarni, "Computer Networking and the Internet" 5th Edition, Pearson Education.
7. Nader F.Mir , Computer and Communication Networks, 1st Edition.
8. Larry I.Peterson&Bruce S.David, "Computer Networks: A System Approach"- 1996.


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BoS Chairman

**140CM9123 ADAPTIVE SIGNAL PROCESSING 3 0 0 3**

**AIM:**

To give some basic concepts about adaptive signal processing via adaptive filtering and applications on biomedical engineering.

**OBJECTIVES:**

- To study the adaptive systems, its characteristics and applications.
- To learn about adaptive algorithms for FIR and IIR filters.
- To learn about the application of adaptive signal processing.

**UNIT I ADAPTIVE SYSTEMS 10**

Definition - Characteristics - Application areas - Properties – Wiener Filter – Adaptive Linear Combiner - Performance function - Gradient and Minimum Mean Square Error (MMSE) - Gradient Search Methods - Newton's method, Steepest Descent technique.

**UNIT II ADAPTIVE ALGORITHMS FOR FIR FILTERS 10**

Least-Mean-Square (LMS) algorithm - Convergence – Learning Curve - LMS Variants - Recursive Least Squares (RLS) Algorithm - Exponentially Weighted RLS – Sliding Window RLS – Kalman Filter.

**UNIT III ADAPTIVE ALGORITHMS FOR IIR FILTERS 10**

Problem formulation - Implications of feedback - MMSE techniques – Output Error Method – Equation Error Method - Hyperstable Adaptive Recursive Filter – SHARF - Limitations in use of Adaptive IIR filters.

**UNIT IV RECURSIVE ADAPTIVE FILTERS ORDER 5**

Lattice Digital filter structure - Properties - Estimate of reflection Coefficients - Order update & Time update analysis.

**UNIT V APPLICATIONS OF ADAPTIVE SIGNAL PROCESSING 10**

Adaptive Modeling & System Identification - Inverse Adaptive Modeling – Deconvolution – Equalization - Adaptive Interference Canceling - Adaptive noise canceling - Canceling power supply interference in ECG – canceling maternal ECG interference in fetal ECG - Adaptive echo cancellation in Telephone channels - Harmonic cancellation with adaptive prediction - Adaptive self tuning filter - Adaptive Line enhancer.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Windrow B and Stearns .S D, "Adaptive Signal Processing", Prentice Hall inc., 2001.
2. Haykin S, "Adaptive Filter Theory", Prentice Hall Inc, 2002.
3. Cowan C F N and Grant P M, "Adaptive Filters", Prentice Hall inc., 1985.
4. Alexander S T, "Adaptive Signal Processing: Theory and Applications ", Springer – Verlag, 1990.
5. Sayed F," Fundamentals of Adaptive Filters ", Wiley Interscience,2002.
6. Diniz P S R, "Adaptive Filtering Algorithms and Practical Implementation", Kluer, 2nd Edition, 2004.


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BoS Chairman

**140CM9124 HIGH SPEED SWITCHING ARCHITECTURES 3 0 0 3**

**AIM:**

High Speed Switching Architectures enables students to learn the technologies and protocols needed to design and implement a converged switched network.

**OBJECTIVES:**

On completion of the course the students are expected to

- have sufficient fundamental knowledge of switching technology
- build sufficient knowledge on ATM switching architecture
- have sufficient knowledge to work as Network Professionals

**UNIT I LAN SWITCHING TECHNOLOGY 9**

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

**UNIT II ATM SWITCHING ARCHITECTURE 9**

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

**UNIT III QUEUES IN ATM SWITCHES 9**

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

**UNIT IV PACKET SWITCHING ARCHITECTURES 9**

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

**UNIT V IP SWITCHING 9**

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

**L: 45, T: 0, Total: 45**

**REFERENCES:**


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


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BoS Chairman

**140CM9125 LABVIEW BASED SIGNAL PROCESSING 3 0 0 3**

**AIM:**

To pursue the signal processing concepts using LabVIEW software utility blocks.

**OBJECTIVES:**

- To introduce LabVIEW environment with fundamental tools
- To understand Data Acquisition systems and the requirements for interfaces
- To learn Signal generation tools in LabVIEW
- To learn signal processing through LabVIEW specified toolkits.
- To know the role of LabVIEW in digital communication through relevant toolkits

**UNIT I LABVIEW ENVIRONMENT 9**

Conventional Instruments and Virtual Instruments – Graphical programming – LabVIEW evolution - Front Panel – Block diagram – Tools, Controls and Functions Palettes – SubVI – Icon and Connector. Structures, Charts and Graphs – Arrays and Clusters – Strings - Time and Dialog – Property nodes.

**UNIT II DATA ACQUISITION SYSTEMS AND INTERFACES 9**

Data Acquisition systems – Functional blocks – Analog and Digital I/O – Multiplexed inputs. GPIB, PCI, PXI, VXI, VISA. File handling and Report generation in LabVIEW.

**UNIT III SIGNAL GENERATION USING LABVIEW 9**

Signal generation - overview – normalized frequency –Basic functions – sinusoids – wave and pattern Vis - Generating channel models. Measurement VIs – calculating frequency spectrum of a signal - Coherent gain and Equivalent Noise Bandwidth. Harmonic distortion. SignalExpress – LabVIEW Analyze sub palette.

**UNIT IV MULTIRATE SIGNAL PROCESSING LABVIEW 9**

Signal Processing – Power Spectrum – FFT – LabVIEW Signal Processing sub palette. Spectral analysis – Spectral leakage – Windowing - Sampling window shape – Spectral measurement toolset. Digital filtering – Digital filtering design toolkit.

**UNIT V DIGITAL COMMUNICATION AND LABVIEW 9**

Sampling – Getting signal to LabVIEW - Upsampling – down sampling – Resampling. Digital Receiver – Choosing sampling rate – SNR. Sampling methods – Digital Oscilloscope – RF Spectrum analyzer – Analog sampling card – Sound card. Building a communication Systems – Modulator – Demodulator – Channel impairments – Signal detection and recovery – Synchronization – NI modulation toolset. System performance – Performance measures – Channel estimation – channel decoding – Viterbi decoder.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Cory L Clark, 'LabVIEW Digital Signal Processing' McGraw Hill, 2005.
2. Sanjay Gupta, Joseph John, 'Virtual Instrumentation using LabVIEW' Fifth reprint, Tata McGraw Hill, 2005
3. Mahesh L. Chugani Abhay R. Samant Michael Cerna, 'LabVIEW Signal Processing' Prentice Hall, 1998
4. Gary W Johnson Richard Jennings. 'LabVIEW Graphical Programming' Fourth Edition, McGraw Hill, 2006
5. NI LabVIEW SignalExpress Manual, Version 2.0, National Instruments Corp, 2007.


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BoS Chairman

**140CM9126** **MICROWAVE INTEGRATED CIRCUITS** **3 0 0 3**

**AIM:**

To familiarize the students with the design and fabrication of monolithic MICS, lumped elements and microstrip lines.

**OBJECTIVES:**

On completion of the course, the student will be able to:

- Differentiate thick film and thin film technology
- Understand the process involved in the fabrication of MICS
- Analyze microstrip line
- Classify different types of couplers
- Design lumped elements

**UNIT I TECHNOLOGY OF HYBRID MICS** **9**

Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices.

**UNIT II TECHNOLOGY OF MONOLITHIC MICS** **9**

Processes involved in fabrication – Epitaxial growth of semiconductor layer – growth of dielectric layer – diffusion-ion implantation – electron beam technology.

**UNIT III ANALYSIS OF MICROSTRIP LINE** **9**

Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in miscrostrips.

**UNIT IV COUPLED MICROSTRIPS, SLOT LINE AND COPLANAR WAVEGUIDES** **9**

Coupled microstrips – even and odd mode analysis – Microstrip directional couplers – branch line couplers – periodic branch line couplers – synchronous branch line couplers.

**UNIT V LUMPED ELEMENTS AND NON-RECIPROCAL COMPONENTS** **9**

Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors – ferromagnetic substrates for non-reciprocal devices – microstrip circulators – latching circulators – isolators – phase shifters.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Gupta,K.C, and Amarjit singh , "Microwave Integrated Circuits" ,John Wiley and sons ,Wiley Eastern, Reprint, 1978.
2. Hoffmann, R.K, "Handbook of Microwave Integrated Circuits" ,Artech House,


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BoS Chairman

**140CM9127** **INTERNETWORKING AND MULTIMEDIA** **3 0 0 3**

**(Common to AE and CM Programmes)**

**AIM:**

To give the exposure to the students on the concepts of interworking, multimedia and relevant protocols, and applications.

**OBJECTIVES:**

- To study the basic concepts of multimedia networking.
- To learn about multicast and transport protocol.
- To understand the concepts of multimedia servers.
- To know the applications of multimedia and interworking.

**UNIT I MULTIMEDIA NETWORKING** **9**

Digital sound, video and graphics, basic multimedia networking, multimedia characteristics, evolution of Internet services model, network requirements for audio/video transform, multimedia coding and compression for text, image, audio and video.

**UNIT II BROAD BAND NETWORK TECHNOLOGY** **9**

Broadband services, ATM and IP, IPV6, High speed switching, resource reservation, Buffer management, traffic shaping, caching, scheduling and policing, throughput, delay and jitter performance.

**UNIT III MULTICAST AND TRANSPORT PROTOCOL** **9**

Multicast over shared media network, multicast routing and addressing, scaping multicast and NBMA networks, Reliable transport protocols, TCP adaptation algorithm, RTP, RTCP.

**UNIT IV MEDIA – ON – DEMAND** **9**

Storage and media servers, voice and video over IP, MPEG over ATM/IP, indexing synchronization of requests, recording and remote control.

**UNIT V APPLICATIONS** **9**

MIME, Peer–to–peer computing, shared application, video conferencing, centralized and distributed conference control, distributed virtual reality, light weight session philosophy.

**L: 45, T: 0, Total 45**

**REFERENCES:**


1. Jon Crowcroft, Mark Handley, Ian Wakeman. "Internetworking Multimedia", Harcourt Asia Pvt.Ltd. Singapore, 1998.
2. Szuprowicz. B.O., "Multimedia Networking", McGraw Hill, New York. 1995.
3. Tay Vaughan," Multimedia making it to work", 4ed, Tata McGraw Hill, New Delhi, 2000.


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**140CM9128** **RADAR AND NAVIGATIONAL AIDS** **3 0 0 3**

**AIM:**

To make the students to understand the principles of Radar and its use in military, civilian environment and also to familiar with navigational aids.

**OBJECTIVES:**

On completion of the course, the student will be able to:

- Discuss the nature of detection
- Apply Doppler principles to radars
- Refresh principles of antennas
- Understand the concepts of transmitters and receivers
- Understand navigation of ships
-

**UNIT I INTRODUCTION TO RADAR** **9**

Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies – Applications of Radar – The Origins of Radar The Radar Equation Introduction- Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency- Antenna Parameters- System losses – Other Radar Equation Considerations

**UNIT II MTI AND PULSE DOPPLER RADAR** **9**

Introduction to Doppler and MTI Radar- Delay –Line Cancelers- Staggered Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics -Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).

**UNIT III DETECTION OF SIGNALS IN NOISE** **9**

Introduction – Matched –Filter Receiver –Detection Criteria – Detectors —Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters - Frequency-Scan Arrays Radar Transmitters- Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter. Radar Receivers - The Radar Receiver - Receiver noise Figure – Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

**UNIT IV NAVIGATION AND DETECTION** **9**

Introduction - Four methods of Navigation . Radio Direction Finding - The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders Radio Ranges - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments. Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System

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**UNIT V DME and TACAN** **9**

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment, Aids to Approach and Landing - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) Doppler Navigation - The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems. Inertial Navigation - Principles of Operation - Navigation Over the Earth – Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems. Satellite Navigation System - The Transit System - Navstar Global Positioning System (GPS)

**L: 45, T: 0, Total: 45**

**TEXTBOOKS:**


1. Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003.
2. Nagaraja. N.S., "Elements of Electronic Navigation Systems", 2nd Edition, TMH, 2000.


**REFERENCES:**


1. Peyton Z. Peebles:, "Radar Principles", Johnwiley, 2004
2. Toomay. J.C., " Principles of Radar", 2nd Edition –PHI, 2004


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BoS Chairman

**140CM9129** **RESEARCH METHODOLOGY** **3 0 0 3**

**(Common to AE and CM Programmes)**

**AIM:**

To study the context of planning and development, that the significance of research lies in its quality.

**OBJECTIVES:**

- To enable researchers, in developing the most appropriate methodology for their research studies.
- To make the researchers familiar with the art of using different research methods and techniques.
- To study the different methods of data collection, measurement and scaling techniques.
- To understand the several parametric tests of hypotheses.
- To study the analysis of data and the art of writing research reports.

**UNIT I INTRODUCTION AND DATA COLLECTION** **9**

Research methodology – definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modelling research, algorithmic research, Research process – steps. Data collection methods – Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design – Secondary data – internal sources of data, external sources of data.

**UNIT II SCALES AND SAMPLING** **9**

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q– sort scale. Sampling methods– Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non–probability sampling method – convenience sampling, judgment sampling, quota sampling.

**UNIT III HYPOTHESES TESTING–I (PARAMETRIC TESTS)** **9**

Hypotheses testing – Testing of hypotheses concerning means (one mean and difference between two means – one tailed and two tailed tests), concerning variance – one tailed Chi–square test.

**UNIT IV HYPOTHESES TESTING–II (NONPARAMETRIC TESTS)** **9**

Nonparametric tests – One sample tests – one sample sign test, Kolmogorov – Smirnov test, run test for randomness, Two sample tests – Two sample sign test, Mann – Whitney U test, K– sample test – Kruskal Wallis test (H – Test).

**UNIT V DATA ANALYSIS AND REPORT PREPARATION** **9**

Introduction to Disciminant analysis, Factor analysis, cluster analysis, multidimensional scaling, conjoint analysis. Report writing – Types of report, guidelines to review report, typing instructions, oral presentation.

**L: 45, T: 0, Total 45**

**REFERENCES:**


1. Kothari, C.R., "Research Methodology –Methods and techniques", New Age Publications, New Delhi, 2009.
2. Panneerselvam, R., "Research Methodology", Prentice–Hall of India, New Delhi, 2004.


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BoS Chairman

**140CM9130 VLSI FOR WIRELESS COMMUNICATION 3 0 0 3**

**AIM:**
To apply the concepts of VLSI Techniques in the field of wireless communication.

**OBJECTIVES:**
At the end of the course the student will be able to

- Know the various channel modeling
- Gain knowledge on multipath fading
- Design narrow band LNA
- Compare different types of mixtures

**UNIT I OVERVIEW OF MODULATION SCHEMES 6**
Classical Channel - Wireless Channel Description - Path Loss - Channel Model and Envelope Fading - Multipath Fading: Frequency Selective and Fast Fading - Summary of Standard Translation.

**UNIT II RECEIVER FRONT END & AMPLIFIER DESIGN 13**
Filter Design - Rest of Receiver Front End: Non idealities and Design Parameters - Nonlinearity –Noise - Derivation of Noise Figure. Low Noise Amplifier Design - Wideband LNA - Design Narrowband LNA - Impedance Matching - Automatic Gain Control Amplifiers – Power Amplifiers

**UNIT III MIXERS 13**
Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion - Low Frequency Case: Analysis of Gilbert Mixer – Distortion - High-Frequency Case – Noise - A Complete Active Mixer. Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain in Single Ended Sampling Mixer - Distortion in Single Ended Sampling Mixer - Intrinsic Noise in Single Ended Sampling Mixer - Extrinsic Noise in Single Ended Sampling Mixer- Demodulators.

**UNIT IV FREQUENCY SYNTHESIZERS 8**
Phase Locked Loops - Voltage Controlled Oscillators - Phase Detector – Analog Phase Detectors – Digital Phase Detectors - Frequency Dividers - LC Oscillators - Ring Oscillators - Phase Noise - A Complete Synthesizer Design Example (DECT Application).

**UNIT V LOOP FILTER 5**
General Description - Design Approaches.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2002.
2. Emad N Farag and Mohamed I Elmasry, "Mixed Signal VLSI Wireless Design - Circuits and Systems", Kluwer Academic Publishers, 2000.
3. Pui-In Mak, Seng-Pan U, Rui Paulo Martins, "Analog-baseband architectures and Circuits for multistandard and low voltageWireless transceivers", springer, 2007.
4. Wolfgang Eberle, "Wireless Transceiver Systems Design",Springer, 2008.


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BoS Chairman

**140CM9131 WIRELESS SENSOR NETWORKS TECHNOLOGY 3 0 0 3**

**AIM:**
To apply the concepts of WSN in designing protocols.

**OBJECTIVES:**
At the end of the course the student will be able to

- Understand the characteristics of WSN.
- Design the medium access control protocols.
- Gain knowledge in data gathering protocols.
- Discuss the applications of WSN.

**UNIT I CHARACTERISICS OF WSN 9**

Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

**UNIT II MEDIUM ACCESS CONTROL PROTOCOLS 9**

Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention-based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

**UNIT III ROUTI NG AND DATA GATHERING PROTOCOLS 9**

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

**UNIT IV EMBEDDED OPERATING SYSTEMS 9**

Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

**UNIT V APPLICATIONS OF WSN 9**

WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.
3. Akkaya. K. and Younis. M., "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349, 2005.
4. Philip Levis, " TinyOS Programming",2006 – www.tinyos.net


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BoS Chairman

**140CM9132** **MULTI USER DETECTION** **3 0 0 3**

**AIM:**
To apply the concepts of Multiuser detection technique in designing different detectors.

**OBJECTIVES:**
At the end of the course the student will be able to

- Understand the basics of CDMA model.
- Design the matched filter for filters in CDMA system.
- Analyze Rayleigh fading
- Analyze Successive Cancellation techniques.

**UNIT I CODE DIVISION MULTIPLE ACCESS CHANNEL** **9**

Basic synchronous and asynchronous CDMA model – Signature waveforms – Data streams – Modulation – Fading – Antenna arrays – Background noise – Discrete time synchronous and asynchronous models.

**UNIT II SINGLE-USER MATCHED FILTER** **9**

Hypothesis testing – Optimal receiver for the single user channel – The Q function – The matched filter in the CDMA system – Asymptotic Multiuser efficiency and related measures – Coherent single user matched filter in Rayleigh fading – Differentially coherent demodulation – Noncoherent modulation.

**UNIT III OPTIMUM MULTIUSER DETECTION** **9**

Optimum detector for synchronous channels – Optimum detector for asynchronous channels – Minimum error probability in synchronous channel – K user optimum asymptotic efficiency and Near – far resistance – Minimum error probability in the asynchronous channel – Performance analysis in Rayleigh fading – Optimum noncoherent multiuser detection.

**UNIT IV DECORRELATING DETECTOR** **9**

Optimum linear multiuser detection – Minimum Mean Square Error (MMSE) linear multiuser detection – Performance of MMSE linear multiuser detection – Adaptive MMSE linear multiuser detection – Canonical representation of linear multiuser detectors – Blind MMSE multiuser detector.

**UNIT V NON - DECORRELATING DETECTOR** **9**

Optimum linear multiuser detection – Minimum Mean Square Error (MMSE) linear multiuser detection – Performance of MMSE linear multiuser detection – Adaptive MMSE linear multiuser detection – Canonical representation of linear multiuser detectors – Blind MMSE multiuser detector.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Sergio Verdu, "Multiuser detection", Cambridge University Press, 1998.
2. Sergio Verdu, "Recent Progress in Multiuser Detection Advances in Communication and Control Systems", IEEE Press, 1993.


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BoS Chairman

**140CM9133 SMART ANTENNAS 3 0 0 3**

**AIM:**
To gain knowledge in the designing of smart antennas.

**OBJECTIVES:**
At the end of the course the student will be able to

- Understand the concepts of antenna Technology.
- Differentiate types of beam forming techniques.
- Gain knowledge in LMS algorithm
- Process broadband signals using DFT method.
- Discuss different types of music algorithm.

**UNIT I INTRODUCTION & NARROW BAND PROCESSING 12**

Antenna gain, Phased array antenna, power pattern, beam steering, degree of freedom, optimal antenna, adaptive antennas, smart antenna - key benefits of smart antenna technology, wide band smart antennas, Digital radio receiver techniques and software radio for smart antennas. Signal model conventional beamformer, null steering beamformer, optimal beamformer, Optimization using reference signal, beam space processing.

**UNIT II ADAPTIVE PROCESSING 9**

Sample matrix inversion algorithm, unconstrained LMS algorithm, normalized LMS algorithm, Constrained LMS algorithm, Perturbation algorithms, Neural network approach, Adaptive beam space processing, Implementation issues.

**UNIT III BROADBAND PROCESSING 8**

Tapped delay line structure, Partitioned realization, Derivative constrained processor, Digital beam forming, Broad band processing using DFT method.

**UNIT IV DIRECTION OF ARRIVAL ESTIMATION METHODS 8**

Spectral estimation methods, linear prediction method, Maximum entropy method, Maximum likelihood method, Eigen structure methods, Music algorithm – root music and cyclic music algorithm, the ESPRIT algorithm.

**UNIT V DIVERSITY COMBINING 8**

Spatial diversity selection combiner, switched diversity combiner, equal gain combiner, maximum ratio combiner, optical combiner.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Lal Chand Godara, "Smart Antennas" CRC press, 2004.
2. Joseph C Liberti.Jr and Theodore S Rappaport, "Smart Antennas for Wireless Communication: IS-95 and Third Generation CDMA Applications", Prentice Hall 1999.
3. Balanis, "Antennas", John Wiley and Sons, 2005.


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BoS Chairman

**140CM9134 SPREAD SPECTRUM COMMUNICATION 3 0 0 3**

**AIM:**
To apply the concepts of spread spectrum in designing communication systems.

**OBJECTIVES:**
At the end of the course the student will be able to

- Understand the concept of Quadrature multiplexed signaling.
- Differentiate different types of spread spectrum techniques.
- Generate Non-linear codes.
- Gain knowledge in Optimal tracking of wideband signals.
- Analyze the performance of coding techniques.

**UNIT I PERFORMANCE CHARACTERIZATION OF DIGITAL DATA TRANSMISSION 12**
Detection of binary signals in AWGN - Quadrature multiplexed signaling schemes - Signaling through band limited channels - Equalization of digital data transmission system - Realization imperfections - Degradations in performance. Communication in the presence of pulse noise jamming - Low probability detection scheme - Direct Sequence Spread Spectrum (DSSS) and Frequency Hop Spread Spectrum Systems and examples of Spread Spectrum Systems.

**UNIT II SPREAD SPECTRUM SYSTEMS 9**
Direct sequence spread spectrum methods employing BPSK, QPSK and MSK - Frequency Hop spread spectrum methods - Coherent slow frequency Hop technique - Non coherent slow and fast frequency Hop spread spectrum techniques - Hybrid DS/FH spread spectrum - Complex envelope representation of spread spectrum systems

**UNIT III BINARY SHIFT REGISTER SEQUENCES FOR SPREAD SPECTRUM SYSTEMS 8**
Definition - PN sequence generator fundamentals - Maximal length sequences - Properties, Power spectrum and Polynomial tables for maximal length sequences - Gold codes - Rapid Acquisition systems - Non-linear code generators.

**UNIT IV SYNCHRONIZATION OF SPREAD SPECTRUM SYSTEMS 8**
Optimal tracking of wideband signals - Early-late tracking loops - Code tracking loops for FHSS - Optimum synchronization techniques - Multiple dwell and sequential detectors - Synchronization using a matched filter - Synchronization by estimating the received spreading code

**UNIT V PERFORMANCE OF SPREAD SPECTRUM SYSTEM 8**
SS Systems communications models - Performance without coding under AWGN and different jamming environments - spread spectrum systems performances with forward error correction - Block coding - Convolutional coding and specific error correcting codes - Inter leaving - Random coding bounds.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Ziemer R E and Peterson R L, "Digital Communication and Spread Spectrum Systems", Macmillan Publishing Co., 1985.
2. Dixon R C, "Spread Spectrum Systems", Wiley Interscience, 1976.
3. Holms J K, "Coherent Spread Spectrum Systems", Wiley Interscience, 1982.


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**140CM9135** **FPGA BASED SYSTEM DESIGN** **3 0 0 3**

**AIM:**

To apply the concepts HDL in the design of FPGA based system.

**OBJECTIVES:**

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

- Understand the different type of modeling technique of VHDL
- Gain knowledge in the basic concepts of PLA
- Understand the concepts of FPGA architecture
- Apply the concepts of FPGA in DSP based design.

**UNIT I INTRODUCTION TO HDL** **9**

Introduction to VHDL – Behavioral modeling – Data Flow Modeling – Structural Modeling. Introduction to Verilog – Gate Level Modeling – Data Flow Modeling – Behavioral Modeling.

**UNIT II PROGRAMMABLE LOGIC DEVICES** **9**

Basic Concepts, Programming Technologies – Progrmmable Logic Array (PLA), Programmable Array Logic (PAL) , Programmable Logic Array (PLA), Design of State Machine using ASM Chart as a design Tool.

**UNIT III FIELD PROGRAMMABLE GATE ARRAYS** **9**

Introduction – FPGA Technology – DSP Technology Requirement – Design Implementation – FPGA Architectures – Xilinx – Altera Flex – Design Principles using FPGAs – Implementing DSP Functions in FPGA - Applications of FPGA to Software Radio.

**UNIT IV DIGITAL SIGNAL PROCESSING WITH FPGAS** **9**

Design of Binary Adders, Multipliers and Dividers- Design of FIR Filters – Design of IIR Filters – Multirate Signal Processing – Decimation – Interpolation – Polyphase Decomposition – Multistage Decimator – Filter Banks – DFT and FFT Algorithms – Error Control and Cryptography – Modulation and Demodulation – FPGA design of LMS Algorithm

**UNIT V SOFTWARE RADIO** **9**

Block Diagram of Software Radio –Numerically controlled oscillator – Digital Up converters – Digital Down Converters and demodulators – Universal Modulator and Demodulator using CORDIC. Incoherent Demodulation – digital approach for I and Q generation, Special Sampling Schemes. CIC filters, Residue number system and high speed filters using RNS. Down Conversion using discrete Hilbert Transform. Undersampling receivers, Coherent Demodulation Schemes.

**L: 45, T: 0, Total: 45**

**REFERENCES:**


1. Samir Palnitkar, " Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall, 2003.
2. Volnei A Pedroni, "Circuit Design with VHDL", Prentice Hall, 2004.
3. Uwe Meyer Baese, "Digital Signal Processing with Field Programmable Gate Arrays", Springer, 2004.
4. Jeffrey H Reed, "Software Radio: A Modern Approach to Radio Engineering", Pearson Education Asia, 2002.
5. James Tsui, " Digital Techniques for Wideband Receivers", Prentice-Hall of India, 2005.
6. Mitra S K, " Digital Signal Processing", McGraw Hill, 1998.
7. Bob Zeidman, "Designing with CPLDs and FPGAs", CMP, 2002.


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