MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

Madanapalle

(UGC-AUTONOMOUS)

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MASTER OF TECHNOLOGY

DIGITAL ELECTRONICS
&
COMMUNICATION SYSTEMS (DECS)

COURSE STRUCTURE
&
DETAILED SYLLABI

For the students admitted to

Master of Technology Digital Electronics and Communication Systems from the academic year 2016-17 batch onwards

M. Tech Regular Two Year P. G. Degree Course

MADANAPALLE INSTITUTE OF TECHNOLOGY &SCIENCE
(UGC – AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M. Tech. Digital Electronics and Communication Systems [DECS R16]

COURSE STRUCTURE

I YEAR - I Semester

Sl. No.	Course code	Course	Credits
1.	16DECS101	Structural Digital System Design	4
2.	16DECS102	Advanced Computer Networks	4
3.	16DECS103	Digital Communication Techniques	4
4.	16DECS104	Advanced Digital Signal Processing	4
5.	16DECS105	Adaptive Signal Processing	4
6.		**Elective-I**	4
	16DECS401	Transform Techniques	
	16DECS402	Secured Communications	
	16DECS403	Mobile Networks	
7.	16DECS201	Structural Digital System Design Lab	2
		Total	**26**

I YEAR - II Semester

Sl. No.	Course code	Course	Credits
1.	16DECS106	Embedded System Design	4
2.	16DECS107	Image & Video Processing	4
3.	16DECS108	Detection and Estimation Theory	4
4.	16DECS109	Wireless Communications	4
5	16DECS110	Speech Processing	4
5.	16DECS404	**Elective-II**	4
		Software Defined Radio	
	16DECS405	Wireless Sensor Networks	
	16DECS406	Multimedia Communication	
6.	16DECS202	Advanced Communications Lab	2
		Total	**26**

II YEAR (I & II Semesters)

S. No.	Course code	Course	Credits
1.	16DECS501	Seminar	2
2.	16DECS602	Project work	16

Marks Allocation

Sl. No.	Description	Internal Marks			External Marks
1	Theory	Mid -Test		Assignment	50
		30		20	
2	Practical	Experiment	Record Work	Viva - voce	50
		30	10	10	
3	Seminar	50			-

M. Tech I Year - I SEM (DECS)

STRUCTURAL DIGITAL SYSTEM DESIGN

(16DECS101**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To study about structural functionality of different Digital blocks (Both combinational and Sequential)
2. To provide an exposure to ASM charts, their notations and their realizations.
3. To provide an exposure to VHDL and different styles of modelling using VHDL.
4. To introduce concept of micro programming and study issues related to micro programming

UNIT I

BUILDING BLOCKS FOR DIGITAL DESIGN: Multiplexer, Demultiplexer, Decoder, Encoder, Comparator, Adder, ALU, Carry-look-ahead adder.

BUILDING BLOCKS WITH MEMORY: Clocked building blocks, register building blocks, RAM, ROM, PLA, PAL, Timing devices.

UNIT II

DESIGN METHODS: Elements of design style, top-down design, separation of controller and architecture, refining architecture, and control algorithm, Algorithmic State Machines, ASM chart notations.

UNIT III

REALISING ASMS - Traditional synthesis from ASM chart, multiplexer controller method, one-shot method, ROM based method.

ASYNCHRONOUS INPUTS AND RACES - Asynchronous ASMs, Design for testability, test vectors, fault analysis tools.

UNIT IV

MICROPROGRAM AND DESIGN: Microprogramming, Microprogramme sequencer 2910, designing micro programmed computer. Power distribution noise, cross talk, reflections, line -drivers and receivers.

UNIT V

MODELLING WITH VHDL: CAD tools, simulators, schematic entry, synthesis modeling with VHDL.

DESIGN CASE STUDIES: Single pulser, system clock, serial to parallel data conversion, traffic light controller.

Course Outcomes:

After Completion of this course students will be able to

1. Understand structural functionality of different digital blocks
2. Represent and Realize their designs in ASM charts
3. Represent their designs in different modelling styles by using VHDL
4. Understand concept of Micro program and issues related to micro programming

Text Books:

1. Prosser and Winkel, "The Art of Digital Design", Prentice Hall.
2. Roth, “Digital System Design using VHDL”, Mc. Graw Hill, 2000

Reference Books:

1. William Fletcher, An Engineering Approach to Digital Design, 1st Edition, Prentice-Hall India, 1997.
2. William J Dally and John W Poulton, Digital Systems Engineering, Cambridge University Press,2008.
3. JayaramBhasker, A VHDL Primer, 3rd edition, Prentice-Hall India, 2009.
4. J. Bhasker; A VHDL Primer, Addison - Wesley.
5. VHDL for Programmable Logic - Kevin Skahill, Cypress Semiconductors

M. Tech I Year - I SEM (DECS)

ADVANCED COMPUTER NETWORKS

(16DECS102**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To study about different protocols related to advanced computer networks such as wireless Lans, Wimax and so on.
2. To study about security features associated with different advanced computer networks.

UNIT I

Review of data communication standards, topologies, OSI, TCP/IP models, Transmission media, circuit switched networks, packet switched networks, Point to Point Protocol (PPP), Asymmetric Digital Subscriber Line (ADSL)

UNIT II

Fast Ethernet, Gigabit Ethernet, Wireless LANs, Bluetooth, WiMax, Virtual LANs,

UNIT III

Advanced Network Architectures -SONET/SDH, Frame Relay and ATM architectures and services, VPN architectures, IP over ATM, MPLS, RSVP

UNIT IV

IPv6 protocol, Socket interface, Domain Name System, Simple Mail Transfer Protocol, WWW and HTTP, Simple Network Management Protocol

UNIT V

Voice over IP, Cryptography, Network security, Digital Signatures, IPSec, Firewalls

Course Outcomes:

After completion of this course students will be able to

1. Know the functioning different protocols associated with modern computer network system
2. Know the security features associated with modern computer network system.

Text Books:

1. BEHROUZ A. FOROUZAN, "Data Communications and Networking", 4th Ed, Tata McGraw-Hill, New Delhi, 2006
2. LEON-GARCIA, INDRA WIDJAJA, "Communication Networks – Fundamental concepts and Key architectures", TMH, 2000

Reference Books:

1. Jim Kurose, KeithRoss, "Addison *Computer Networking: a Top down Approach",* 4th edition, Wesley, July 2007.
2. Andrew S. Tanenbaum "Computer Networks", 4th Edition, Pearson Education, 2008
3. William Stallings, "Data and Computer Communication", 9th edition, Prentice hall, 2010

M. Tech I Year - I SEM (DECS)

DIGITAL COMMUNICATION TECHNIQUES

(16DECS103**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To study about base band signal concepts and different equalizers.
2. To study in detail about coherent detection schemes such as ASK, FSK, PSK
3. To study in detail about M-array signaling schemes like QPSK, QAM, MSK.

UNIT I

REVIEW OF RANDOM VARIABLES AND RANDOM PROCESSES:
Random variable, Moment generating function, Markov's inequality, Chebyshev's inequality, Central limit theorem, Different distributions – Gaussian, Poisson, Chi square, Rayleigh, Rician; Correlation - Auto-correlation, Cross correlation, Correlation matrix; Stationary processes, Wide sense stationary processes, Gaussian &Ergodic processes, Problem solving.

UNIT II

COMMUNICATION OVER BAND LIMITED CHANNELS: Communication over band limited Channels- Optimum pulse shaping- Nyquist criterion for zero ISI, partial response signaling- Equalization Techniques,Zero forcing linear Equalization- Decision feedback equalization

UNIT III

CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS: Signal space representations- Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals. Representation of Digitally Modulated Signals-Memory less Modulation Methods.

COMMUNICATION OVER ADDITIVE GAUSSIAN NOISE CHANNELS - I: Optimum waveform Receiver in additive white Gaussian noise (AWGN) channels,Cross correlation receiver, Matched Filter receiver and error probabilities.

UNIT IV

COMMUNICATION OVER ADDITIVE GAUSSIAN NOISE CHANNELS - II: Optimum receivers for arbitrary binary signals and M'ary Orthogonal signals, Analysis of

coherent detection schemes for ASK, PSK and DPSK, QPSK, QAM, M'ary signaling schemes –Performance of the data transmission schemes under AWGN.

SYNCHRONIZATION:
Receiver synchronization, Costas loop, symbol synchronization, Carrier recovery circuits – Symbol clock estimation schemes.

UNIT V

SPREAD SPECTRUM SYSTEMS:
PN sequences, Generation of PN sequences, DS spread spectrum systems, FH spread spectrum systems and performance of DSSS & FHSS in AWGN – Synchronization – Jamming considerations – Commercial Applications, Cellular subsystems.

Course Outcomes:
After completion of this course students will be able to
1. Aware of base band signal concepts and different equalizers.
2. Get complete knowledge regarding coherent detection schemes like ASK, FSK, PSK.
3. Design M-array signaling schemes like QPSK, QAM, MSK

TEXT BOOKS:

1. J. G. Proakis, Digital Communication (4/e), McGraw- Hill, 2001
2. Bernard Sklar, "Digital Communications – Fundamentals &Applications", Prentice Hall, 2001.
3. Spread Spectrum Communications, Marvin K. Simon, Jim K Omura, Robert A. Scholtz, Barry K.Levit,1995.
4. CDMA Principles of Spread Spectrum Communications, Andrew J Viterbi, Addison Wesley, 1995

REFERENCE BOOKS:

1. S. Haykin, Communication Systems (4/e), Wiley, 2001.
2. R. E. Zimer& R. L. Peterson: Introduction to Digital Communication, PHI, 2001.
3. G. R. Cooper & C. D. McGillem, "Modern Communications & Spread Spectrum", McGraw Hill, 1986.
4. L. Hanzoetal, Turbo Coding, Turbo Equalization & Space-Time Coding Wiley, 2002
5. J.G.Proakis , M.Salehi, "Contemporary communication systems" PWS publishing company,

M. Tech I Year - I SEM (DECS)

ADVANCED DIGITAL SIGNAL PROCESSING
(16DECS104**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To study about the digital signal processing algorithms and multi rate signal processing
2. To study about the power spectral estimation by using Barlett, Welch & Blackmann & Tukey methods.
3. The study about the effects of finite word length in fixed-point dsp systems.

UNITI

DSP ALGORITHMS: Fast DFT algorithms based on Index mapping, Sliding Discrete Fourier Transform, DFT Computation Over a narrow Frequency Band, Split Radix FFT, Linear filtering approach to Computation of DFT using Chirp Z-Transform.

UNITII

MULTIRATESIGNALPROCESSING: Decimation by a factor D, Interpolation by a factorI, Sampling rate conversion by a rational factorI/D, Filter design & Implementation for sampling rate conversion.

UNITIII

POWERSPECTRALESTIMATION: Estimation of spectra from finite duration observation of signals, Non-parametric methods: Bartlett, Welch & Blackmann & Tukey methods.

PARAMETRICMETHODSFORPOWERSPECTRUMESTIMATION: Relation between auto correlation & model parameters, Yule-Waker & Burg Methods, MA ARMA models for power spectrum estimation.

UNIT IV

ANALYSISOFFINITEWORDLENGTHEFFECTSINFIXED-POINTDSPSYSTEMS: Fixed, Floating Point Arithmetic–ADC quantization noise & signal quality-FinitewordlengtheffectinIIRdigitalFilters–Finiteword-length effects in FFT algorithms.

UNIT V

APPLICATIONS OF DIGITAL SIGNAL PROCESSING: Dual Tone Multi-frequency Signal Detection, Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non stationary Signals, Musial Sound Processing, Over Sampling A/D Converter, Over Sampling D/A Converter, Discrete-Time Analytic Signal Generation.

Course Outcomes:

After completion of the course students will be able to

1. Gets complete knowledge regarding various algorithms associated with Digital signal processing and multi rate signal processing.
2. Verify the power spectral estimation by using Barlett, Welch &Blackmann&Tukey methods.
3. Understand the effects of finite word length in fixed-point DSP systems by using ADC and FFT algorithms.

Text Books:

1. Sanjit K Mitra, "DigitalSignalProcessing", Tata MCgraw Hill Publications.
2. J G Proakis, D G Manolokis, "DigitalSignalProcessing Principles, Algorithms, Applications" PHI.

Reference Books:

1. A V Oppenhiem, R W Schafer, "Discrete-Time Signal Processing", Pearson Education.
2. Emmanuel C Ifeacher Barrie. W. Jervis, "DSP- A Practical Approach", Pearson Education.
3. S.M.Kay, "ModernspectralEstimationTechniques"PHI, 1997.

M. Tech I Year - I SEM (DECS)

L	T	P	C
4	0	0	4

ADAPTIVE SIGNAL PROCESSING

(16DECS105**)**

Course Objectives:

1. To study in detail about adaptive Systems.
2. To study about various Linear optimum filtering techniques.
3. To study about various techniques related Linear and Non Linear adaptive filtering.

UNIT I

INTRODUCTION TO ADAPTIVE SYSTEMS: *Eigen Analysis* - Eigen Value problem, Properties of eigen values and eigen vectors, Eigen filters, Eigen value computations, *Adaptive Systems* - Definitions, Characteristics, Applications and Examples of Adaptive systems, The adaptive linear combiner – Description, weight vectors, Desired response performance function, Gradient and Mean square error(MSE).

UNIT II

LINEAR OPTIMUM FILTERING: *Wiener Filters* – Linear optimum filtering, Principle of Orthogonality, Wiener-Hopf equations, Error performance surface, Channel Equalization, Linearly constrained minimum variance filter, *Linear Prediction* – Forward and Backward linear prediction, Levinson-Durbin Algorithm, Properties of prediction error filters, AR modeling of stationary stochastic process, Lattice predictors, Joint process estimation, *Kalman Filters* - Recursive mean square estimation for scalar random variables, Kalman filtering problem, The innovations process, Estimation of the state using innovations process, Filtering, Initial conditions, Variants of the Kalman filter, Extended Kalman filter, Problem Solving.

UNIT III

LINEAR ADAPTIVE FILTERING-I: Method of Steepest descent algorithm and its stability, *Least Means Square (LMS) algorithm* – Structure & operation of LMS algorithm, Examples, Stability & performance analysis of the LMS algorithm, Simulations of Adaptive equalization using LMS algorithm, Convergence aspects, *Method of Least Squares (LS)* - Statement, Data windowing, Minimum sum of error squares, Normal equations and linear least squares filters, Properties.

UNIT IV

LINEAR ADAPTIVE FILTERING-II: *Recursive Least Squares (RLS) Algorithm* – Matrix inversion lemma, The exponentially weighted RLS algorithm, Update recursion for the sum of weighted error squares, Example, Convergence Analysis, Simulation of adaptive equalization using RLS algorithm, Order Recursive Adaptive Filters – Adaptive forward and backward linear prediction, Least squares Lattice predictor, QR-Decomposition based Least squares Lattice filters & their properties, Simulation of Adaptive equalization using Lattice Filter.

UNIT V

NON LINEAR ADAPTIVE FILTERING:*Blinddeconvolution* – Theoretical and practical considerations, Bussgang algorithm for blind equalization for real base band channels, Special cases of Bussgang algorithm, Simulation studies of Bussgang algorithms, Problem solving.

***Course outcomes*:**
After the course student will be expected to:

1. Get complete knowledge regarding adaptive systems
2. Design various Linear optimum filters by employing different techniques associated with them
3. Understand various techniques related to with Linear and Non linear adaptive filtering and their design considerations

Text Books:

1. Simon Haykin, "Adaptive Filter Theory," Prentice Hall, 4th Edition, 2002.
2. Bernard Widrow, Samuel D. Strearns, "Adaptive Signal Processing," Prentice Hall, 2005.

Reference Books:

1. Paulo S.R. Diniz, Adaptive Filtering Algorithms and Practical Implementation, Third Edition,Springer, Kluwer Academic Publishers.
2. Alexander D Poularikas, Zayed M Ramadan, Adaptive Filtering Primer with MATLAB, CRC Press Taylor & Francis Group, 2008 Indian Edition.
3. Ali H. Sayed, Adaptive filters, IEEE Press, Wiley-Interscience, A john Wiley & Sons, INC.,Publication.
4. S. Thomas Alexander, "Adaptive Signal Processing-Theory & Applications," Springer – Verlag, 1986

M. Tech I Year - I SEM (DECS)

Elective 1

L	T	P	C
4	0	0	4

TRANSFORM TECHNIQUES

(16DECS401**)**

Course Objectives:

1. Study of different types of transforms which can be applicable for different types of signals.
2. To study the application of wavelets for different types of signals.
3. To study the applications of Multi rate systems and filter banks.

UNIT I

REVIEW OF TRANSFORMS: Signal spaces, concept of convergence, Hilbert spaces for energy signals, Orthogonality, Ortho normality, Fourier basis, FT-failure of FT-need for time-frequency analysis, spectrogram plot-phase space plot in time-frequency plane, Continuous FT, DTFT, Discrete Fourier Series and Transforms, Z-Transform.

ADVANCE TRANSFORMS: Relation between CFT-DTFT, DTFT-DFS, DFS-DFT, DCT (1D&2D), Walsh, Hadamard, Haar, Slant, KLT, and Hilbert Transforms – definition, properties and applications.

UNIT II

CWT & MRA: Time-frequency limitations, tiling of time-frequency plane for STFT, Heisenberg uncertainty principle, Short time Fourier Transform (STFT) analysis, short comings of STFT.
NEED FOR WAVELETS: Wavelet Basis- Concept of Scale and its relation with frequency, Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT.

UNIT III

NEED FOR SCALING FUNCTION: Multi resolution analysis, Tiling of time scale plane for CWT. Important Wavelets: Haar, Mexican Hat Meyer, Shannon, Daubechies.
SPECIAL TOPICS: Wavelet Packet Transform, Bi-orthogonal basis- B-splines, Lifting Scheme of Wavelet Generation-implementation.

UNIT IV

MULTIRATE SYSTEMS, FILTER BANKS AND DWT: Basics of Decimation and Interpolation in time & frequency domains, Two-channel Filter bank, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet basis, DWT Filter Banks for Daubechies Wavelet Function.

UNIT V:

APPLICATIONS OF TRANSFORMS: Signal De-noising, Sub-band Coding of Speech and Music, Signal Compression - Use of DCT, DWT, KLT.

Course Outcomes:

After completion of the course the student will be able to

1. Use different 1-d and 2-d transforms for different signals.
2. Apply wavelet transforms for different signals and will be able to appreciate its differences with other transformations.
3. Use different advanced transforms such as DCT, DWT and KLT for different applications like signal de noisy, sub band coding of speech and music and signal compression.

Text Books:

1. Jaideva C Goswami, Andrew K Chan, "Fundamentals of Wavelets- Theory, Algorithms and Applications", John Wiley & Sons, Inc, Singapore, 1999.
2. RaghuveerM.Rao and Ajit S. Bopardikar, "Wavelet Transforms-Introduction theory and applications" Pearson edu, Asia, New Delhi, 2003.
3. Soman.K.P, Ramachandran K.I, "Insight into Wavelets from Theory to practice", Printice Hall India, First Edition, 2004.

Reference Books:

1. Vetterli M. Kovacevic, "Wavelets and sub-band coding", PJI, 1995.
2. C. Sydney Burrus, "Introduction to Wavelets and Wavelet Transforms", PHI, First Edition, 1997.
3. Stephen G. Mallat, "A Wavelet Tour of Signal Processing", Academic Press, Second Edition,
4. Jayaraman, "Digital Image Processing", TMH,2009
5. S.Jayaraman, S.Esakkirajan, T.Veera Kumar, "Digital Image Processing", TMH,2009

M. Tech I Year - I SEM (DECS)

Elective 1

SECURED COMMUNICATIONS

(16DECS402**)**

L	**T**	**P**	**C**
4	**0**	**0**	**4**

Course Objectives:

1. To study security and different types of attacks.
2. To study about different techniques associated with encryption.
3. To study about different algorithms associated with security.
4. To study about IP security architecture and designing issues related to fire walls.

UNIT I

Information security, Types of attacks, Info security services - Confidentiality, Integrity, Availability, security process - assessment, Implement security, training

UNIT II

Security technologies - Firewalls, VPNs ; Encryption - Private Key Encryption, Public key encryption, Key management; Concepts of intrusion detection.

UNIT III

Message authentications and Hash functions, Digital signatures, e-mail security, IP security architecture, Web security

UNIT IV

Authentication and authorization in WLANs -802.1X authentication, RADIUS protocol; Extensible Authentication protocol, Transport Layer Security and certificates

UNIT V

Data protection in WLANs - WEP, 802.11i security, RSNA, CCMP, TKIP, wireless roaming security, WMAN security.

Course Outcomes:

After completion of this course students will be able to know

1. The need and role of security.
2. Gain knowledge about different techniques associated with encryption.
3. Functioning of different algorithms associated with security.
4. Gain knowledge regarding IP security architecture and designing issues related to fire walls.

Text Books:

1. Eric Maiwald**, "**Fundamental of Network Security", Dreamtech press Osborne MGH, 2004
2. W. Stallings, "Cryptography & Network Security", 3/e, PHI 2003
3. Thomas Hardjono , RD Lakshminath**, "**Security in Wireless LAN & MAN", Artech House, 2005

Reference Books:

1. Roger J. Sutton, "Secure Communications: Applications and Management", WILEY,2002.
2. Don J. Torrieri, "Principles of secure communication systems", 2nd Eedition, ArtechHouse Publishers, 1992.
3. Cryptography and secure Communications by M.Y. Rhee, McGraw Hill

M. Tech I Year - I SEM (DECS)

Elective I

MOBILE NETWORKS

(16DECS403**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To study different wireless communication systems
2. To study in detail about different multiples accessing schemes
3. To study about different architectures in mobile networks such as wireless LAN, Hyper LAN and so on
4. To study about dynamic routing and different routing protocols employed in mobile networks

UNIT I

Wireless communication standards, Cellular communications, GSM protocol architecture,, 3G mobile wireless systems, Beyond 3G.

UNIT II

Multiple Access Techniques - GDMA, TDMA, CDMA, Mobile Data Networks - CDPD, GPRS

UNIT III

Wireless LAN architecture, physical & MAC layers, Wireless ATM architecture, HIPERLAN, Wireless Personal Area (WPAN) networks - Home RF, Bluetooth.

UNIT IV

Mobility management in Wireless Networks, Handoff management, Location management,Mobile IP, TCP Wireless Application Protocol

UNIT V

Mobile Adhoc Networks, Dynamic routing, Route discovery, Routing protocols, Mobile Multimedia Adhoc Networks, MPLS

Course Outcomes:

After completion of the course the student will be able to

1. Gain complete knowledge regarding different wireless communication systems.
2. Gain complete knowledge regarding different multiples accessing schemes.
3. Know the architectures of different mobile networks such as wireless LAN , Hyper LAN and so on
4. Know about different routing mechanisms by employing different routing protocols.

Text Books:

1. JWMark **,**W Zhuang, "Wireless communications & Networking", PHI, 2005
2. KavehPahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", PHI, 2010
3. George Aggelou, "Mobile Adhoc Networks", TMH, 2009.

Reference Books:

1. William Stallings, "Wireless Communications and Networks", Prentice Hall, 2004.
2. Siva Ram Murthy C. and Manoj B. S., "Ad Hoc Wireless Networks: Architectures and Protocols", 2nd Edn. Pearson Education 2005.
3. Toh C. K., "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall, PTR, 2001.
4. Yi-Bing and ImrichChlamtac, "Wireless and Mobile Networks Architectures", John Wiley &Sons, 2001.

M. Tech I Year - I SEM (DECS)

STRUCTURAL DIGITAL SYSTEM DESIGN LAB
(16DECS201)

L	T	P	C
0	0	3	2

Course objectives:

1. To understand about VHDL and Verilog Programming in all available styles.
2. To understand differences between Verilog and VHDL.
3. To represent the different digital blocks in verilog and VHDL in all available styles of modelling

LIST OF EXPERIMENTS

Using VHDL and Verilog do the following experiments

1. Design of 4-bit adder / subtractor
2. Design of Booth Multiplier
3. Design of 4-bit ALU
4. Design 32-bit ALU using ripple carry and carry look-ahead logic
5. Design of counters and shift registers
6. Design of MIPS processor
7. Design of Washing machine controller
8. Design of Traffic Light Controller
9. Mini project

Course Out Comes:

After completion of this course the students will be able to understand

1. Different modelling styles available in VHDL and Verilog and difference between them
2. Difference between Verilog and VHDL
3. Representation of different digital modules in different modelling styles available in VHDL and Verilog

M. Tech I Year - II SEM (DECS)

EMBEDDED SYSTEM DESIGN

(16DECS106**)**

Course Objectives:

1. To study about current technologies, integration methods and hardware and software design concepts associated with processor in Embedded Systems.
2. To study about different types of memory and memory management schemes and various interfacing devices related to design of an Embedded System
3. To get detail knowledge regarding testing and hardware software co- design issues pertaining to design of an Embedded System

UNIT I

INTRODUCTION TO EMBEDDED SYSTEMS: Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. Embedded system design flow

UNIT II

EMBEDDED HARDWARE: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.

Embedded board Input / output – Serial versus Parallel I/O, interfacing the I/O components, I/O components and performance, Board buses – Bus arbitration and timing, Integrating the Bus with other board components, Bus performance.

UNIT III

EMBEDDED SOFTWARE: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS, Embedded operating systems: Embedded Linux, RT Linux and windows CE

UNIT IV

DESIGN, DEVELOPMENT, IMPLEMENTATION OF EMBEDDED SYSTEM: Embedded system development life cycle model, creating an embedded system architecture, introduction to embedded software development process and tools- Host and Target machines, linking and locating software, getting embedded software into the target system, issues in Hardware-Software design and co-design. Implementing the design - The main software utility tool, CAD and the hardware, Translation tools, Debugging tools, testing on host machine, simulators, Laboratory tools, System Boot-Up.

UNIT V

PROCESS MODELS AND HARDWARE SOFTWARE CO-DESIGN: Modes of operation – Finite state machine– HCFSL and state charts language – state machine models – Concurrent process model – Concurrent process – Communication among process – Synchronization among process – Implementation - Data Flow model - Design technology-Automation synthesis – Hardware & software co-simulation– IP cores – Design Process Model

Course Outcomes:

After completion of this course the students will be able to understand

1. Gets clear knowledge regarding current technologies and issues relating to hardware and software design concepts associated with processor in Embedded Systems.
2. Gets complete knowledge pertaining to different types of memory and memory management schemes and various interfacing devices related to design of an Embedded System.
3. Different techniques related to testing and hardware software co- design issues pertaining to design of an Embedded System.

Text Books:

1. Introduction to Embedded Systems - Shibu K.V, McGraw Hill**.**
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, TMH Publications, Second Edition, 2008

Reference Books:

1. Tammy Noergaard, "Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers", Elsevier (Singapore) Pvt.Ltd.Publications, 2005.
2. Frank Vahid, Tony D. Givargis, "Embedded system Design: A Unified Hardware/Software Introduction", John Wily & Sons Inc.2002.
3. Peter Marwedel, "Embedded System Design", Science Publishers, 2007.
4. Arnold S Burger, "Embedded System Design", CMP.

M. Tech I Year - II SEM (DECS)

IMAGE AND VIDEO PROCESSING

(16DECS107**)**

L	**T**	**P**	**C**
4	**0**	**0**	**4**

Course Objectives:

1. To understand different transforms related to gray scale and color images.
2. To get complete knowledge regarding different techniques associated with Image Enhancement, Image Restoration, Image Segmentation and Image Compression.
3. To get clear knowledge regarding motion estimation, video filtering and video standards

UNIT I

IMAGE FUNDAMENTALS & TRANSFORMS: Gray scale and colour Images, image sampling and quantization. Two dimensional orthogonal transforms: DFT, WHT, Haar transform, KLT, DCT.

UNIT II

IMAGE ENHANCEMENT: Filters in spatial and frequency domains, histogram-based processing, and homomorphic filtering. Edge detection, Non parametric and model based approaches, LOG filters, localization problem.

IMAGE RESTORATION: Degradation Models, PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods.

UNIT III

IMAGE SEGMENTATION: Pixel classification, Bi-level Thresholding, Multi-level Thresholding, P-tile method, Adaptive Thresholding, Spectral & spatial classification, Edge detection, Hough transform, Region growing.

UNIT IV

IMAGE COMPRESSION: Compression models, Information theoretic perspective, Fundamental coding theorem. Huffman Coding, Arithmetic coding, Bit plane coding, Run length coding, Lossy compression: Transform coding, Image compression standards.

UNIT V

VIDEO PROCESSING: Representation of Digital Video, Spatio-temporal sampling, Motion Estimation. Video Filtering, Video Compression, Video coding standards.

Course Outcomes:

After completion of this course the students will be able to

1. Different transforms related to gray scale and color images.
2. Complete knowledge regarding different techniques associated with Image
3. Enhancement, Image Restoration, Image Segmentation and Image Compression.
4. Understand basic concepts regarding to motion estimation, video filtering and video standards

Reference Books:

1. R. C. Gonzalez, R. E. Woods, "Digital Image Processing", Pearson Education. 2nd edition,2002
2. W. K. Pratt, "Digital image processing", Prentice Hall, 1989
3. Rosenfold and A. C. Kak, "Digital image processing", Vols. 1 and 2, Prentice Hall, 1986.
4. H. C. Andrew and B. R. Hunt, "Digital image restoration", Prentice Hall, 1977
5. R. Jain, R. Kasturi and B.G. Schunck, "Machine Vision", McGraw-Hill International Edition, 1995
6. M. Tekalp, "Digital Video Processing", Prentice-Hall, 1995
7. Bovik, "Handbook of Image & Video Processing", Academic Press, 2000

M. Tech I Year - II SEM (DECS)

DETECTION AND ESTIMATION THEORY

(16DECS108**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To provide knowledge about various estimation and detection techniques.
2. To analyze different methods & to detect and estimate the signal from noisy signal.
3. Estimate and detect the signals in the presence of noise.

UNIT I

DETECTION THEORY: Binary decisions - Single observation- Maximum likelihood decision criterion, Neymann-Pearson criterion, Probability of error criterion, Bayes risk criterion, Minimax criterion, Robust detection, Receiver operating characteristics.

UNIT II

BINARY DECISIONS - MULTIPLE OBSERVATIONS: Vector observations, the general Gaussian Problem, Waveform Observation in Additive Gaussian Noise, The Integrating Optimum Receiver; Matched Filter Receiver.

UNIT III

ESTIMATION THEORY: Methods -Maximum likelihood estimation; Bayes cost method Bayes estimation criterion - Mean square error criterion; Uniform cost function; absolute value cost function; Linear minimum variance - Least squares method; Estimation in the presence of Gaussian noise - Linear observation; Non-linear estimation.

UNIT VI

PROPERTIES OF ESTIMATORS: Bias, Efficiency, Cramer Rao bound Asymptotic properties, Sensitivity and error analysis.
STATE ESTIMATION: Prediction, Kalman filter.

UNIT V

SUFFICIENT STATISTICS AND STATISTICAL ESTIMATION OF PARAMETERS: Concept of sufficient statistics, Exponential families of Distributions, Exponential families and Maximum likelihood estimation, uniformly minimum variance unbiased estimation

Course Outcomes:

The students will be able to apply various methods of signal estimation knowing the significance of each method.

1. The students will be able to know Cramer-Rao Lower bound in estimating a signal.
2. By applying suitable criterion the students will be able to detect the signals with minimum errors in the presence of noise.

TEXT BOOKS:

1. James L. Melsa and David L. Cohn, “Decision and Estimation Theory," McGraw Hill, 1978.
2. 2. Dimitri Kazakos, P. Papantoni Kazakos, “Detection and Estimation," Computer Science Press, 1990.
3. Steven M. Kay, “Statistical Signal Processing: Vol. 1: Estimation Theory, Vol. 2: Detection Theory," Prentice Hall Inc., 1998.

REFERENCES:

1. Harry L. Van Trees, “Detection, Estimation and Modulation Theory, Part 1," John Wiley & Sons Inc. 1968.
2. Jerry M. Mendel, “Lessons in Estimation Theory for Signal Processing, Communication and Control," Prentice Hall Inc., 1995
3. Sophocles J. Orfanidis, “Optimum Signal Processing," 2 nd edn., McGraw Hill, 1988.
4. Monson H. Hayes, “Statistical Digital Signal Processing and Modeling," John Wiley & Sons Inc., 1996

M. Tech I Year - II SEM (DECS)

WIRELESS COMMUNICATIONS

(16DECS109**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand basics of Wireless Communications and its evolution process.
2. To learn about the mechanism of radio mobile propagation and its effects.
3. To understand various types of diversity and equalization techniques to counter balance the effects of Wireless Channel.
4. To Study about importance of Wireless Networking and multiple access techniques in the present day mobile communications
5. To design and analyze mobile systems using OFDM technology for mitigating the ISI effects at higher data rates.

UNIT I

INTRODUCTION TO WIRELESS COMMUNICATION SYSTEMS& CELLULAR CONCEPT: Evolution of Mobile Radio Communication Systems, Examples of Wireless Communication Systems, 1G, 2G, 2.5G, and 3G Wireless Cellular Networks and Standards, Frequency Reuse Concept, Channel Assignment Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems, Problem Solving.

UNIT II

MOBILE RADIO PROPAGATION: Introduction to Large Scale Path Loss, Free Space Propagation Model, *Propagation Mechanisms* – Reflection, Diffraction, and Scattering, Practical Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models.

Small Scale Fading and Multipath: Small Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small Scale Multipath Measurements, Parameters of Mobile Channels, Types of Small Scale Fading (all variations*), Statistical Models* – Clarke's Model for Flat Fading, Jake's Model, Level Crossing Rate, Simulation of Clarke's/Jake's Model, Two Ray Rayleigh Fading Model, Problem Solving.

UNIT III

EQUALIZATION & DIVERSITY TECHNIQUES:

Equalization: Survey of Equalization Techniques, Linear and Non-linear Equalizers – Linear Transversal Equalizer, Decision Feedback Equalizer (DFE), Algorithms for Adaptive Equalization – Zero Forcing, LMS, RLS, Fractionally Spaced Equalizers.

Diversity Techniques: Realization of Independent Fading Paths, *Receiver Diversity* – System Model, Selection Combining, Threshold Combining, Maximal Ratio Combining, Rake receiver, Equal Gain Combining, *Transmit Diversity*–Channel known at Transmitter, Channel unknown at Transmitter – the Alamouti Scheme, analysis.

UNIT IV

MULTIPLE ACCESS TECHNIQUES & NETWORKING:

Introduction to Multiple Access: FDMA, TDMA, CDMA, SDMA, Packet Radio, Capacity of Cellular Systems, Problem Solving.

Introduction to Wireless Networking: Introduction to Wireless Networks, Differences between Wireless and Fixed Telephone Networks, Development of Wireless Networks, Traffic Routing in Wireless Networks, Wireless Data Services, Common Channel Signaling.

UNIT V

MULTICARRIER MODULATION:

Data Transmission using Multiple Carriers, Multicarrier Modulation with Overlapping Subchannels, Discrete Implementation of Multicarrier Modulation, The Cyclic Prefix, Orthogonal Frequency Division Multiplexing (OFDM), Matrix Representation of OFDM, Vector Coding, Challenges in Multicarrier Systems, Problem Solving.

***Course Outcomes**:*

After completion of this course the students will be able to

1. Understand basics of Wireless Communications and its evolution process.
2. Know about the mechanism of radio mobile propagation and its effects.
3. Apply various types of diversity and equalization techniques to counter balance the effects of Wireless Channel.
4. Recognize the importance of Wireless Networking and multiple access techniques in the present day mobile communications
5. Analyze and design mobile systems using OFDM technology for mitigating the ISI effects at higher data rates.

Reference Books:

1. T. S. Rappaport, "Wireless Communications, Principles and Practice," Prentice Hall, 2nd Edition, 2002.
2. Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005.
3. David Tse, PramodViswanath, "Fundamentals of Wireless Communications," Cambridge University Press, 2006.
4. Dr. KamiloFeher, "Wireless Digital Communications," Prentice Hall, 1995.

M. Tech I Year - II SEM (DECS)

SPEECH PROCESSING

(16DECS110**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To understand how speech signals are processed for Analysis and Synthesis. Also to understand speech processing in the context of its creation (anatomy, classification of sounds, etc.) as well as in its perception (psychology & neuroscience).
2. To analyze tools that needed for analysis and synthesis, in the areas of digital signal processing for time-frequency analysis.

UNIT I

FUNDAMENTALS OF DIGITAL SPEECH PROCESSING: Anatomy & Physiology of Speech organs, the process of speech production, the acoustic theory of speech production, Digital models for speech signals.

TIME DOMAIN MODELS FOR SPEECH PROCESSING: Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate ,Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

UNIT II

LINEAR PREDICTIVE CODING (LPC) ANALYSIS: Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition, Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT III

HOMOMORPHIC SPEECH PROCESSING: Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational

Considerations, the Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, TheHomomorphicVocoder.

SPEECH ENHANCEMENT: Nature of interfering sounds, Speech enhancement techniques, Spectral subtraction, Enhancement by re-synthesis.

UNIT IV

AUTOMATIC SPEECH RECOGNITION: Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System,. Continuous digit Recognition System

SPEAKER RECOGNITION: Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System.

UNIT V

HIDDEN MARKOV MODEL (HMM) FOR SPEECH: Hidden markov model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS, Adapting to variability in speech, Language models.

Course Outcomes:

After completing the course, the student will be familiar with the principles and the techniques used in speech processing. This includes speech synthesis, speech coding and speech recognition.

Reference Books:

1. L.R Rabiner and S.W.Schafer, “Digital processing of speech signals”, Pearson.
2. Douglas O Shaughnessy, “Speech communication”, Second Edition Oxford University press, 2000.
3. L.R Rabinar and B.H.Juang, “Fundamentals of Speech Recognition”
4. Thomas F. Quateri, “Discrete Time Speech Signal Processing”, 1/e, Pearson
5. Ben Gold & Nelson Morgan, “Speech & Audio Signal Processing”, 1/e, Wiley

M. Tech I Year - II SEM (DECS)

Elective 2

SOFTWARE DEFINED RADIO

(16DECS404**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To study about requirements, benefits and different models for Software Defined Radio
2. To study in detail about Software Defined Radio Architectures for performance optimization
3. To get complete knowledge regarding functioning of different blocks and techniques associated with Software Defined Radio.

UNIT I

Requirement for Software defined radio, Benefits of multi-standard terminals, Operational requirements, models for SDR, Smart antenna systems,

UNIT II

Software defined radio architectures, Hardware specifications, Digital aspects of Software defined radio, Current technology limitations, minimum power consumption, ADC performance trends

UNIT III

Flexible RF receiver architectures, Digital receiver, Single carrier and multi-carrier designs, undersampling, oversampling, Noise figure, Receiver sensitivity, ADC spurious signals

UNIT IV

Multiband Flexible receiver design, RF Transmit / receive switch, Image rejection mixing, Dynamic range enhancement, Feed forward techniques, cascaded non-linearity techniques

UNIT V

Flexible transmitters, Power amplifiers, Analog quadrature upconvertion, Interpolated bandpassupconversion, PLL based modulator transmitter, All-pass filtering, Polyphase filtering

Course Outcomes:

After completion of this course the students will be able to

1. Analyze requirements, benefits and different models for Software Defined Radio.
2. Understand in detail about Software Defined Radio Architectures for performance optimization.
3. Gets complete knowledge regarding functioning of different blocks and techniques associated with Software Defined Radio.

Reference Books:

1. P Kenington, "RF and Baseband Techniques for Software Defined Radio", Artec House, 2005
2. JoukoVanakka, "Digital Synthesizers and Transmitter for Software Radio", Springer, 2005
3. Wally H. W. Tuttlebee**, "**Software Defined Radio: Baseband Technologies for 3G Handsets and Base stations",John Wiley & sons , 2003

M. Tech I Year - II SEM (DECS)

Elective 2

WIRELESS SENSOR NETWORKS

(16DECS405**)**

L	T	P	C
4	0	0	4

Course Objectives:

1. To study about different types of sensor networks, advantages, applications and the mechanism of transportation and processing involved in Wireless Sensor Networks.
2. To study about representation and different protocols and mechanisms involved in routing of Wireless Sensor Networks.
3. To study about tools and simulators associated with Wireless Sensor Networks.

UNIT I

Sensor networks, advantages and applications, Sensor Network Applications - Habitat Monitoring, Smart Transportation, Collaborative Processing

UNIT II

Localization and tracking,- sensing model, Distributed Representation, Tracking Multiple Objects networking sensors- Medium Access Control, *Energy-Aware Routing to a Region,* Attribute-Based Routing

UNIT III

Infrastructure Establishment -Clustering and time synchronizations, Localization and localization services, Sensor tracking and control - Task-Driven Sensing, Information-Based Sensor Tasking, Sensor Group Management

UNIT IV

Sensor Network data bases - Sensor Database Challenges , Query Interfaces , Data-Centric Storage, Multidimensional Indices for Orthogonal Range Searching, Locality-Preserving Hashing

UNIT V

Sensor Network Platforms and Tools -Sensor Network hardware, Node level software, Node-Level Simulators, wireless sensor networks positioning and location management.

Course Outcomes:

After completion of this course the students will be able to

1. Understand different types of sensor networks, advantages, applications and the mechanism of transportation and processing involved in Wireless Sensor Networks.
2. Understand about representation and different protocols and mechanisms involved in routing of Wireless Sensor Networks.
3. Gets complete knowledge regarding different tools and simulators associated with Wireless Sensor Networks.

Reference Books:

1. F. Zhao, C Guibas, "Wireless Sensor Networks", Elsevier, Morgan Kaufmann, 2004.
2. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks -Technology, Protocols and Applications", John Wiley & Sons, 2007.

M. Tech I Year - II SEM (DECS)

Elective 2

MULTIMEDIA COMMUNICATIONS

(16DECS406**)**

L	**T**	**P**	**C**
4	**0**	**0**	**4**

Course Objectives:

1. To study basic requirements of Multimedia Communications.
2. To study about different coding schemes involved in Multimedia Communications.
3. To study about different standards and protocols related Multimedia Communications and its networks.

UNIT I

Multimedia communications - multimedia requirements, Audio Visual integration - Lip synchronization, Audio-to-visual mapping, Bio-model person verification, Joint Audio-Video coding

UNIT II

Multimedia information processing, Perceptual coding of digital audio signals - hybrid coder - differential perceptual audio coder, Image coding, Video coding, Water marking

UNIT III

ANNS for multimedia processing - NN techniques for motion estimation, face detection and recognition, Distributed multimedia systems, IP based networks, Multimedia Operating Systems.

UNIT IV

Multimedia Communication Standards - overview of MPEG 1, MPEG-2, MPEG-4 and MPEG-7., Real time multimedia transmission across the Internet

UNIT - V

Multimedia Communication across networks - packet audio / video, Streaming video across internet, Multimedia transport across IP/ATM Networksand Wireless networks

Course Outcomes:

After completion of this course the students will be able to

1. Gets knowledge regarding fundamentals of Multimedia Communications.
2. Understand about different coding schemes involved in Multimedia Communications.
3. Gets complete knowledge regarding different standards and protocols related Multimedia Communications and its networks

Reference Books:

1.K.RRAO et al, "Multimedia Communication Systems: Techniques and Standards", Pearson, 2002.

2.Tay Vaughan, "Multimedia- Making it Work", TMH, 5th Edn, 2001

3.P.K ANDLEIGH , K. THAKKAR, "Multimedia Systems Design", PHI,2002

M. Tech I Year - II SEM (DECS)

ADVANCED COMMUNICATIONS LAB

(16DECS202**)**

L	**T**	**P**	**C**
0	**0**	**3**	**2**

Course Objectives:

1. To generate random data at given rates and employ different modulation schemes over generated data.
2. To simulate different modulated signals and diversity schemes over AWGN, and estimate data reception using different algorithms.
3. To implement RAKE receiver and estimate its performance through BER curve.

List Of Experiments:

1. Generation of Random data at a given data rate (Hardware & Software) – (M-Sequence).
2. Simulation of Rayleigh fading channel incorporating speed of the mobile & Power delay profile
3. Simulation of BPSK system over AWGN channel & finding its performance with BER plot.
4. Implementation of Equalization at the receiver to remove ISI caused due to Low channel bandwidth
5. Simulation of CDMA signal using QPSK modulation scheme &obtain matched filter response over AWGN Channel
6. Implementation of RAKE receiver & finding its performance through BER Curve
7. Implementation of L.M.S algorithm to estimate the original data when it is corrupted by noise & channel.
8. Implementation of R.L.S algorithm to estimate the original data when it is corrupted by noise & channel.

Software Required: MATLAB – 7.0 & above

Course Outcomes:

After completion of this course the students will be able to

1. Generate random data at given rates and employ different modulation schemes over generated data.
2. Simulate different modulated signals and diversity schemes over AWGN, and estimate data reception using different algorithms.
3. Implement RAKE receiver and estimate its performance through BER curve.