R14 & R15 PG Syllabus:

M.Tech. Schema

Specialization: Digital Electronics & Communications Systems (DECS)

I Semester

S. No	Subject Code	Subjects	L	T	P	IM	EM	CR
1	14541101	Digital System Design	4	0	0	40	60	4
2	14541102	Embedded Systems	4	0	0	40	60	4
3	14541103	Advanced DSP	4	0	0	40	60	4
4	14541104	Digital Communication Techniques	4	0	0	40	60	4
5	14541105	Adaptive Signal Processing	4	0	0	40	60	4
6	 14541106 14541107 14541105	Elective-1: 1. Advanced Computer Architecture 2. DSP Processors & Architecture 3. Filter banks and wavelets	4	0	0	40	60	4
7.	14541108	Digital System Design Lab	0	0	3	50	50	2
Total:						290	410	26

II Semester

S. No	Subject Code	Subjects	L	T	P	IM	EM	CR
1	14541201	Wireless Communications	4	0	0	40	60	4
2	14541202	Detection and Estimation of Signals	4	0	0	40	60	4
3	14541203	Image and Video Processing	4	0	0	40	60	4
4	14541204	Microcomputer System Design	4	0	0	40	60	4
5	14541205	VLSI Design and Technology	4	0	0	40	60	4
6	 14541206 14541207 14541208	Elective-2: 1. Internetworking 2. Multimedia Communications 3. Optical Communication	4	0	0	40	60	4
7.	14541209	Communications & Signal Processing (CSP) Lab	0	0	3	50	50	2

Total:				290	410	26

III Semester

S. No	Subject Code	Subjects	IM	EM	Credits
1	14542101	Seminar	100	---	2

IV Semester

S. No	Subject Code	Subjects	IM	EM-	Credits
1	14542202	Project	50	50	16

Grand Total Credits: 70

SYLLABI

M.Tech. I Sem. (ECE)

Digital System Design

Course Objectives:

1. To analyze and design combinational and sequential logic circuits.
2. Troubleshooting faults regarding Digital Systems.

UNIT I

Design of Figital Systems: ASM charts, Hardware description language and control sequence method, Reduction of state tables, state assignments ,design of sequential circuits using ROMs and PLAs, sequential circuit design using CPLD, FPGAs.

UNIT II

Fault Modeling & Test Generation : Fault classes and models – Stuck at faults, bridging faults, transition and intermittent faults, Fault diagnosis of Combinational circuits by conventional methods- Path Sensitization technique, Boolean difference method, Kohavi algorithm.

UNIT III

Test Pattern Generation & Fault Diagnosis: D – algorithm, PODEM, Random testing, Signature Analysis and testing for bridging faults ,Design of fault detection.

UNIT IV

Programmable Logic Arrays: Design using PLAs, PLA minimization and PLA folding
Fault models, Test generation and Testable PLA design.

UNIT V

Asynchronous Sequential Machine: Fundamental mode model, flow table, state reduction, minimal closed covers, races, cycles and hazards.

Text Books:

1. Z. Kohavi – "Switching & finite Automata Theory" (TMH)
2. N. N. Biswas – "Logic Design Theory" (PHI)
3. Nolman Balabanian, Bradley Calson – "Digital Logic Design Principles" – Wily Student Edition 2004.

Refrence Books:

1. Charles H. Roth Jr. – "Fundamentals of Logic Design".
2. Frederick. J. Hill & Peterson – "Computer Aided Logic Design" – Wiley 4 Th Edition.

M.Tech. I Sem. (ECE)

Embedded Systems

Course Objectives:

- The main objective of the course is to get students familiar with the typical problems and constraints that arise when designing and developing embedded systems
- The course will also introduce theoretical and practical solutions to these typical problems that the students are expected to master and be able to apply to realistic case studies
- To understand the concepts of real time operating system

UNIT-I

Introduction: Embedded system overview, embedded hardware units, embedded software in a system, embedded system on chip (SOC), design process, classification of embedded systems.

UNIT-II

Embedded Computing Platform: CPU Bus, memory devices, component interfacing, networks for embedded systems, communication interfacings: RS232/UART, RS422/RS485, IEEE 488 bus.

Instruction Sets: Introduction, preliminaries, ARM processor, SHARC processor.

UNIT- III

Survey of Software Architecture: Round robin, round robin with interrupts, function queue scheduling architecture, selecting an architecture saving memory space.

Embedded Software Development Tools: Host and target machines, linkers, locations for embedded software, getting embedded software into target system, debugging technique.

UNIT-IV

RTO's Concepts: Architecture of the kernel, interrupt service routines, semaphores, message queues, pipes.

UNIT-V

System Design Techniques: Design methodologies, requirement analysis, specifications, system analysis and architecture design.

Design Examples: Telephone PBX, ink jet printer, water tank monitoring system, GPRS, Personal Digital Assistants, Set Top boxes.

Text Books:

1. Embedded Systems- Architecture, Programming and Design-RajKamal, 2nd, TMH
2. Computers as a component: principles of embedded computing system design- Wayne wolf
3. An embedded software premier: David E. Simon
4. Embedded / real time systems-KVKK Prasad, Dreamtech press, 2005

Reference Books:

1. Embedded real time systems programming-sri ram V Iyer, Pankaj gupta, TMH, 2004
2. Embedded system design- A unified hardware/software introduction- Frank vahid, Tony D.Givargis, John Willey, 2002

M.Tech. I Sem. (ECE)

Advanced Digital Signal Processing

Course Objectives:

1. To make the students familiar with design of digital filters and DFTs of sequences with different lengths.
2. To give the students an idea about multirate signal processing that is useful to combine signals of different frequencies.
3. To make the students familiar with the architecture of DSP processors and related soft wares

UNIT I

Overview: Discrete-Time Signals, Sequences and sequence Representation, Discrete-Time Systems, Time-Domain Characterization and Classification of LTI Discrete-Time Systems.

LTI Discrete-Time Systems In The Transform Domain: Types of Linear-Phase transfer functions, Simple Digital Filters, Complementary Transfer Function, Inverse Systems, System Identification, Digital Two-Pairs, Algebraic Stability Test.

UNIT II

Digital Filter Srtucture and Design: All Pass Filters, Tunable IIR Digital Filter, IIR Tapped Cascade Lattice Structures, FIR Cascaded Lattice Structures, Parallel All Pass Realization of IIR Transfer Functions, Digital Sine-Cosine Generator, Computational Complexity of Digital Filter Structures.

DSP Algorithems: 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.

UNIT III

Analysis of Finite Wordlength Effects in Fixed-Point DSP Systems: Fixed, Floating Point Arithmetic – ADC quantization noise & signal quality-Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

Multirate Signal Processing: Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Filter design & Implementation for sampling rate conversion.

UNIT IV

Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric methods: Bartlett, Welch & Blackmann & Tukey methods.
PARAMETRIC METHODS FOR POWER SPECTRUM ESTIMATION: Relation between auto correlation & model parameters, Yule-Waker & Burg Methods, MA & ARMA models for power spectrum estimation.

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, DiscreteTime Analytic Signal Generation.

Text Books:

1. Digital Signal Processing by Sanjit K Mitra, Tata MCgraw Hill Publications.
2. Digital Signal Processing Principles, Algorithms, Applications by J G Proakis, D G Manolokis, PHI.

Reference Books:

1. Discrete-Time Signal Processing by A V Oppenhiem, R W Schafer, Pearson Education.

2. DSP- A Practical Approach- Emmanuel C Ifeacher Barrie. W. Jervis, Pearson Education.
3. Modern spectral Estimation techniques by S. M .Kay, PHI, 1997

M.Tech I Sem.

Digital Communication Techniques

Objectives:

1. To Understand basic components of digital communication systems.
2. To Design optimum receivers for digital modulation techniques.
3. To Analyze the error performance of digital modulation techniques.
4. To Design digital communication systems under given power, spectral and error performance constrains.

UNIT I

Review of Random Variables and Processes: Random variable, different distributions- Gaussian, Rayleigh, and Ricean distributions, Moment generating function, Markov's inequality, Chebyshev's inequality, Central limit theorem, Correlation- Auto correlation, Cross correlation, correlation matrix, Stationary processes, Wide sense stationary processes, Gaussian and Ergodic processes, problem solving.

UNIT II

Baseband Signal Concepts:

Baseband data transmission, Nyquist criterion for zero ISI, Correlative level coding, Data detection, Optimum design of transmit and receive filters, Equalization- Linear, adaptive, fractionally spaced and decision feedback equalizers.

UNIT III

Digital Modulation Schemes:

Detection using matched filters- Optimum receivers for arbitrary binary signals in M'ary Orthogonal signals, Analysis of coherent detection schemes for ASK, FSK, PSK and DPSK, M'ary signaling schemes- QPSK, QAM, MSK, performance of the data transmission schemes under AWGN, Trellis coded modulation.

UNIT IV

Synchronization:

Receiver synchronization, costas loop, symbol synchronization, synchronization with CPM- data aided and Non aided synchronization- synchronization methods based on properties of wide sense cyclo-stationary random process- Carrier recovery circuits – symbol clock estimation schemes.

UNIT V

Orthogonal Frequency Division Multiplexing (ofdm): Carrier Synchronization, Timing synchronization, Multichannel and Multicarrier Systems.

Text Books:

1. J. Proakis, Digital Communications, McGraw Hill, 2000
2. Bernerd Sklar, " Digital Communications- Fundamentals & Applications, "Prentice Hall, 2001
3. Marvin K. Simon, Jim K Omura, Robert A. Scholtz, Barry K.Levit, Spread Spectrum Communications, 1995.
4. Andrew J Viterbi, CDMA Principles of Spread Spectrum Communications, Addison Wesley, 1995.

Reference Books:

1. Ahmad R S Bahai ,Burton R Saltzberg ,Mustafa Ergen, "Multi-carrier Digital Communications: Theory and Applications of OFDM." Springer Publications.
2. J.S.Chitode, "Digital Communication", Technical Publications.
3. Edward. A. Lee and David. G. Messerschmitt, "Digital Communication", Allied Publishers (second edition).
4. J Marvin.K.Simon, Sami. M. Hinedi and William. C. Lindsey, "Digital Communication Techniques", PHI.

5. William Feller, “An introduction to Probability Theory and its applications”, Vol 11, Wiley 2000

M.Tech. I Sem. (ECE)

Adaptive Signal Processing

Course Objectives:

1. To build a strong foundation in adaptive signal processing.
2. To develop the mathematical theory for realizing various linear adaptive filtering algorithms.
3. To make the students familiar with various applications of adaptive signal processing.

UNIT-I

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

UNIT-II

Development of Adaptive Filter Theory & Searching the Performance surface: Introduction to Filtering - Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance - Minimum Mean Square Error.
Searching the performance surface – Methods & Ideas of Gradient Search methods - Gradient Searching Algorithm & its Solution - Stability & Rate of convergence - Learning Curves.

UNIT-III

Steepest Descent Algorithms: Gradient Search by Newton’s Method, Method of Steepest Descent, Comparison of Learning Curves.

UNIT-IV

LMS Algorithm & Applications: Overview of the structure and operation of the LMS algorithm, LMS Adaptation algorithms, Stability & Performance analysis of LMS Algorithms Examples – Instantaneous Frequency measurement, Adaptive noise cancellation applied to sinusoidal interference, Adaptive beamforming

UNIT-V

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

Text Books:

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

Reference Books:

1. Optimum signal processing: An introduction - Sophocles. J. Orfamadis, 2nd Ed., 1988, McGraw-Hill, New York
2. Adaptive signal processing-Theory and Applications - S.Thomas Alexander, 1986, Springer –Verlag.

M.Tech. I sem. (Elective-I) (ECE)

Advanced Computer Architecture

Course Objectives:

- To make student learn the advanced concepts related to computer architecture and storage systems

UNIT I

Fundamentals of Computer Design: Technology trends, cost- measuring and reporting performance quantitative principles of computer design.

Instruction Set Principles and Examples: classifying instruction set- memory addressing- type and size of operands- addressing modes for signal processing operations in the instruction set, instructions for control flow, encoding an instruction set, the role of compiler

UNIT II

instruction Level Parallelism (ILP): overcoming data hazards reducing branch costs, high performance instruction delivery, hardware based speculation, limitation of ILP

ILP Software Approach: compiler techniques- static branch protection, VLIW approach, H.W support for more ILP at compile time- H.W verses S.W solutions

UNIT III

Memory Hierarchy Design: cache performance, reducing cache misses penalty and miss rate, virtual memory, protection and examples of VM.

UNIT IV

Multiprocessors and Thread Level Parallelism: symmetric shared memory architectures, distributed shared memory, Synchronization, multi threading.

UNIT V

Storage Systems- Types, Buses, RAID, errors and failures, bench marking a storage device, designing a I/O system.

Interconnection Networks and Clusters: interconnection network media, practical issues in interconnecting networks- examples, clusters, designing a Cluster

Text Books:

1. Computer Architecture A quantitative approach 3rd edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier)

References:

1. Kai Hwang and A.Briggs “Computer Architecture and parallel processing”, International Edition McGraw-Hill.
2. Dezso Sima, Terence Fountain, Peter Kacsuk, “Advanced Computer Architectures”, Pearson.

M.Tech I sem. (Elective-I) (ECE)

DSP Processors & Architectures

Course Objectives:

1. To make students familiar with P-DSP's and Architectures for DSP devices.
2. To make students familiar with programmable DSP's
3. To make students familiar with basic DSP algorithms.

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UNIT I

Intoroduction to Programmable DSPS: Multiplier & Multiplier accumulator, Modified bus structures & memory access schemes in P–DSPs, Multiple access memory, Multi ported memory, VLIW architecture, Pipelining, Special addressing modes in P–DSPs, On chip peripherals.

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT II

Architectures for Programmable DSP Devices: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT III

Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming.

Implementations of Basic DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

UNIT IV

Implementation of FFT Algorithms: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

Interfacing Memory and I/O Peripherals to Programmable DSP Devices:

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

UNIT V

Recent Trends in DSP System Design: An over-view of the application nodes on DSP systems, An over-view of open multimedia applications platform (OMAP), An Introduction to FPGA, Design flow for an FPGA based system design, Cad tools for FPGA based system design, soft core processors, FPGA based DSP system design, New algorithms for Implementation of filters in VLSI, Distributed arithmetic algorithm, Case studies, Comparison of the performances of the systems designed using FPGAs and digital signals processors.

Text Books:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M. Bhaskar, TMH, 2004.

Reference Books:

1. Digital Signal Processing – Jonathan Stein, John Wiley, 2005.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

M.Tech I sem. (Elective-I) (ECE)

Filter Banks and Wavelets

Course Objectives:

- The objective of the course is to provide the knowledge about Filter banks, Continuous Wavelet Transform & Discrete Wavelet Transform, Wavelet Filters, Embedded wavelet Coding,

UNIT-I

Introduction: Overview and notation
Filters: Sampling, time-invariance, ideal filters, Fourier analysis, bases and frames; time, frequency, and scaling.
Downscaling and Unscaling: Matrices, subsampling in frequency domain, z-domain; sampling interchange.

UNIT-II

Filter Banks: Perfect reconstruction, polyphase matrix, efficient filter banks, upsampling and reconstruction, lattice structure.
Orthogonal Filter Banks: Paraunity matrices, orthonormal filter banks, halfband filters, spectral factorizaiton, Daubechies filters.

UNIT-III

Multiresolution: Wavelets from filters, scaling function by recursion, infinite product formula, biorthogonal wavelets.
Wavelet Theory: Accuracy, cascade algorithm, smoothness, splines and semi-orthogonal wavelets, multifilters and wavelets.

UNIT-IV

Finite Length Signals: Circular convolution, symmetric extension, cosine bases and DCT, smooth local cosine bases, boundary filters and wavelets.
M-Channel Filter Banks: Freedom versus structure, polyphase form, perfect reconstruction, cosine-modulated filter banks, multidimensional filters and wavelets.

UNIT-V

Applications: Fingerprints, image and video compression; speech, audio, and ECG compression; shrinkage, denoising, and feature detection; communcation applications, wavelet integrals for differential equations.

Textbooks:

1. G. Strang and T. Nguyen, Wavelets and Filter Banks, Wellesley-Cambridge Press, MA, 1996.
2. C. Sidney Burrus and Ramesh A. Gopinath, Introduction to Wavelets and Wavelet Transforms

M.Tech I Sem.

Digital System Design Lab

Course Objectives:

1. To Give Awareness regarding Digital system design
2. To Get Acquainted With Hardware description language (VHDL)

List of Experiments:

1. Gates, D Flip-Flop 7474, JK-Flip-Flop
2. Decade Counter-7490, 4-bit counter-7490
3. Shift registers-7495, Universal shift registers-74194/195
4. 3-8 Decoder-74138, 2-4 Decoder-74139
5. Priority Encoder -74x148, 4-bit Comparator-7485
6. 8x1 Multiplexer-74150, 16x1 Multiplexer-74151
7. RAM(16x4)-74189 (Read and Write Operation)
8. Stack and Queue Implementation Using RAM
9. ALU Design
10. Implementation of Digital Design using FPGA and CPLD

(Using VHDL)

M.Tech. II Sem. (ECE)

Wireless Communications

Course Objectives:

1. To understand the cellular radio concepts such as frequency reuse, handoff and how interference between mobiles and base stations affects the capacity of cellular systems.
2. To understand the principles of cooperative communications and describe their advantages and design issues and understand propagation effects such as fading, time delay spread, and Doppler spread.
3. To describe and evaluate receiver and transmitter diversity techniques and understand basic equalization schemes commonly used in mobile wireless systems.

UNIT I

Introduction to Wireless Communications Systems: Evolution, Examples of Wireless Communication systems, Comparison, Second Generation Cellular Networks, WLL, Bluetooth and Personal Area Networks.

Mobile Radio Propagation: Large-Scale Path Loss, Introduction to Radio Wave Propagation, Free Space Propagation Model, Propagation Mechanisms, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering.

UNIT II

Small-Scale Fading and Multipath Fading: Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small-Scale Fading, Rayleigh and Ricean Distributions, Statistical Models for Multipath Fading Channels, Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels.

Diversity Techniques: Repetition coding and Time Diversity- Frequency and Space Diversity, Receive Diversity- Concept of diversity branches and signal paths- Combining methods- Selective diversity combining - Switched combining- maximal ratio combining- Equal gain combining- performance analysis for Rayleigh fading channels.

UNIT III

Cellular Communication: cellular networks, multiple access: fdm/tdm/fdma/tdma, spatial reuse, co-channel interference analysis, Hand over Analysis, Erlang Capacity Analysis, Spectral efficiency and Grade of Service- Improving capacity - Cell splitting and sectorization.

UNIT IV

Spread Spectrum and CDMA: Motivation- Direct sequence spread spectrum- Frequency Hopping systems, Time Hopping., Anti-jamming- Pseudo Random (PN) sequence, Generation of PN sequences.

Diversity in DS-SS Systems: Rake Receiver- Performance analysis. Spread Spectrum Multiple Access, CDMA Systems- Interference Analysis for Broadcast and Multiple Access Channels, Capacity of cellular CDMA networks- Reverse link power control, Hard and Soft hand off strategies.

UNIT V

Fading Channel Capacity: Capacity of Wireless Channels- Capacity of flat and frequency selective fading channels, Multiple Input Multiple output (MIMO) systems- Narrow band multiple antenna system model, Parallel Decomposition of MIMO Channels- Capacity of MIMO Channels.

Cellular Wireless Communication Standards: GSM specifications and Air Interface, specifications, IS 95 CDMA- 3G systems: UMTS & CDMA 2000 standards and specifications.

Text Books:

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University press.
2. Simon Haykin and Michael Moher, “Modern Wireless Communications”, Person Education.
3. T.S. Rappaport, “Wireless Communication, principles & practice”, PHI, 2001.

Reference Books:

1. G.L Stuber, “Principles of Mobile Communications”, 2nd edition, Kluwer Academic Publishers.
2. Kamilo Feher, „Wireless digital communication□, PHI, 1995.
3. R.L Peterson, R.E. Ziemer and David E. Borth, “Introduction to Spread Spectrum Communication”, Pearson Education.
4. A.J.Viterbi, “CDMA- Principles of Spread Spectrum”, Addison Wesley, 1995.

M.Tech. II Sem. (ECE)

Detection and Estimation of Signals

Course Objectives:

1. To provide knowledge about various estimation techniques like parametric and non parametric estimation techniques.
2. To provide knowledge for finding good estimators.
3. To provide enough knowledge for detection of signal in noise and estimate the signals in the presence of noise.

UNIT-I

Introduction to Discrete-Ttime Signals: Fourier Transform of a discrete time signal. Amplitude and phase spectrum. Frequency content and sampling rates. Transfer function. Frequency response.
Random – Discrete-time signals: Review of probability – Random data –Filtered signals – Autocorrelation and power spectral density.

UNIT-II

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

UNIT-III

Detection of Signals in Noise: Minimum probability of Error criterion, Neyman-Pearson criterion for Radar detection of constant and variable, amplitude signals, Matched Filters, optimum formulation, detection of random signals, simple problems thereon with multisample cases.

UNIT-IV

Estimation of signals in Noise: Linear mean squared estimation, non-linear estimates, MAP and ML estimates, maximum likelihood estimate of parameters of linear system, simple problems theoreon.

UNIT- V

Recursive Linear Mean Squared Estimation: Estimation of a signal parameter. Estimation of time-varying signals, Kalman filtering, Filtering signals in noise, Treatment restricted to two variable case only, Simple problems.

Text Books:

1. Signal processing: Discrete Spectral analysis, Detection and Estimation, Mischa Schwartz and Leonard Shaw, Mc-Graw Hill Book Company, 1975.
2. Shanmugam and Breipohl, 'Detection of signals in noise and estimation', John Wiley &Sons, New York, 1985.

Reference Books:

1. E.L. Van Trees, Detection, Estimation and Modulation Theory, Wiley, New York, 1968.
2. Srinath, Rajasekaran & Viswanathan, Introduction to statistical Signal processing with Applications, Prentice Hall of India, New Delhi, 110 001,1989.

3. Steven .M.Kay, *Modern Spectral Estimation, Theory and Applications*, New age International Private Ltd,2011.

M.Tech II Sem. (ECE)

Image and Video Processing

Course Objectives:

1. To provide an introduction to the basic concepts and techniques used in digital image and video processing.
2. To give an understanding of the two-dimensional sampling and quantization
3. To study Edge detection and Image Enhancement Algorithms

UNIT I

Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels.
Image Transforms: 2 D- Discrete Fourier Transform and its properties, Hadamard transform, Discrete Cosine Transform (DCT), Haar transform, KL Transform

UNIT II

Image Enhancement: Spatial domain methods: Point processing, Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.
Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Homonorphic filtering. .

UNIT III

Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models - Lossy & Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, JPEG
Standards.

UNIT IV

Image Segmentation: Segmentation concepts, Point, Line and Edge Detection. Edge linking, Thresholding, Region Based segmentation
Basic concepts of Video Processing: Definition of video signal, Analog and digital video signal, Video Compresson, motion estimation and compensation signals, Filtering operations.

UNIT V

Coding Techniques: Transform coding, Predictive coding, Motion estimation algorithms, Search algorithms for Block Matching in motion estimation, video compression standards, Application of motion estimation in Video coding.

Text Books:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Digital Image Processing – S.Jayaraman, S.Esakkirajan, T.Veera Kumar–TMH, 2009.

Reference Books:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International
3. Multidimentional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier
4. Digital Image Processing with MATLAB and LabView – Vipula Singh, Elsevier.

M.Tech. II Sem. (ECE)

Microcomputer System Design

Course Objectives:

- To become familiar with 8086,80X86,Pentium & Pentium IV Microprocessor Architecture, Instructions, Operating Modes, Programming.
- To study I/O, Multi programming and Arithmetic Coprocessor.

UNIT I

Review of 8086 Processor: Architecture, Register organization, Addressing Modes and Instruction Set (Brief treatment only), Difference between 8086 and 8088 with rest to pin structures.

The 80286 Microprocessors: Architecture, Register Organization, Addressing Modes and instruction sets of 80286 (brief treatment only)

UNIT II

The 80386, and 80486 Microprocessors: Architectural features, Register Organization, Memory management, Virtual 8086 mode, The Memory Paging Mechanism, Pin Definitions of 80386 and 80486 (brief treatment).

UNIT III

The Pentium and Pentium Pro-processors: The Memory System, Input/output system, Branch Pridiction Logic, Cache Structure, Pentium Registers, Serial Pentium pro features.

The Pentium IV and Dual Core Microprocessors: Architecture, Special Registers and Pin Structures (brief treatment only)

UNIT IV

I/O Programming: Fundamentals of I/O Considerations Programmed I/O, Interrupt I/O, Block Transfers and DMA, I/O Design Example.

Introduction to Multiprogramming: Process Management, Semaphores Operations, Common Procedure Sharing, Memory Management, Virtual Memory Concept of 80286 and other advanced Processors.

UNIT V

Arithmetic Coprocessor, MMX and SIMD Technologies: Data formats for Arithmetic Coprocessor, Internal Structure of 8087 and Advanced Coprocessors. Instruction Set (brief treatment).

Text Books:

1. Barry, B. Brey, "The Intel Microprocessors,"8th Edition Pearson Education, 2009.
2. A.K. Ray and K.M. Bhurchandi,"Advanced Microprocessor and Peripherals," TMH.
3. YU-Chang, Glenn A. Gibson, "Micro Computer Systems: The 8086/8088 Family Architecture, Programming and Design" 2nd Edition, Pearson Education, 2007.

Reference Books:

1. The 8088 and 8086 Microprocessors: Programming, Interfacing, Software, Hardware, and Applications : Including the 80286, 80386, 80486, and Pentium Processors Walter A. Triebel, Avtar Singh Prentice Hall, 2000
2. Douglas V. Hall, "Microprocessors and Interfacing," Special Indian Edition, 2006.

M.Tech. II Sem. (ECE)

VLSI Design and Technology

Course Objectives:

- The main objective of the course is to introduce the concepts of IC fabrication technologies and their corresponding Stick Diagrams
- The course will also introduce scaling techniques of CMOS devices and their effects
- The course will also familiarize the students with CAD/EDA tools

UNIT-I

Introduction & Review of MOS & BICMOS Technologies: Logic gates, switching logic, basic electrical properties, circuit design processes & Scaling.

UNIT-II

Combinational Logic Networks: Layout design methods, simulation, Network delay, cross talk, power optimization and testing.

Sequential systems & Clocking disciplines: Design, Power Optimization, Validation & Testing.

UNIT-III

Sub-System Design Principles: Combinational shifters, Adders, ALUs, Multipler, High density memory, FPGA, PLAs.

Floor Planning Methods: Placement- Routing, Power and Clock distribution, Packages – I/O Architecture & Pad Design.

UNIT-IV

Architecture Design: Register Transfer Design, High Level synthesis- Architectures for low power – Architecture Testing.

UNIT-V

Chip Design: Design Methodologies– Examples of chip design from specification to design validation, Introduction to CAD tools and Algorithms, Hardware, Software Co-design.

Ultra fast VLSI Circuits & Systems: Introduction to Ga-As Technology.

Text Books:

1. Wayne Wolf, *Modern VLSI Design*, 2nd Ed, PHI.
2. Douglas A. Pucknell, Kamran Eshraghian, *Basic VLSI Design*, 3rd Ed, PHI.

Reference Books:

1. Principles of CMOS VLSI design- Weste and Eshraghian, Pearson Education.
2. Introduction to VLSI circuits and systems- John P. Uyemura, John Wiley.

M.Tech. II Sem. (Elective-II) (ECE)

Internetworking

Course Objectives:

- The main objective of the course is to get students familiar with the Internetworking concepts, internet addressing and TCP/IP protocol Suite.
- The course will also introduce Mobile IP and multicasting & unicasting routing protocols.
- To understand the IP security and the firewalls.

UNIT-I

Internetworking Concepts: Principles of Internetworking, Connectionless Internetworking, Application level Interconnections, Network level Interconnection, Properties of the Internet, Internet Architecture, Wired LANS, Wireless LANs, Point-to-Point WANs, Switched WANs, Connecting Devices, TCP/IP Protocol Suite.

IP Address: Classful Addressing: Introduction,Classful Addressing, Other Issues, Sub-netting and Super-netting

Classless Addressing: Variable length Blocks, Sub-netting, Address Allocation. Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router.

ARP and RARP: ARP, ARP Package, RARP.

UNIT-II:

Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum, IP V.6. **Transmission Control Protocol (TCP)**: TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times. **Stream Control Transmission Protocol (SCTP):** SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control. **Mobile IP**: Addressing, Agents, Three Phases, Inefficiency in Mobile IP. **Classical TCP Improvements**: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/ Time Out Freezing, Selective Retransmission, Transaction Oriented TCP.

UNIT-III

Unicast Routing Protocols (RIP, OSPF, and BGP): Intra and Inter-domain Routing,Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP.

Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.

UNIT-IV

Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet. **Remote Login TELNET:** Concept, Network Virtual Terminal (NVT). **File Transfer FTP and TFTP:** File Transfer Protocol (FTP). **Electronic Mail:** SMTP and POP. **Network Management-SNMP:** Concept, Management Components, World Wide Web- HTTP Architecture.

UNIT-V

Multimedia: Digitizing Audio and Video, Network security, security in the internet, firewalls. Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Network Security, Security in the Internet, Firewalls.

Text Books:

1. TCP/IP Protocol Suite- Behrouz A. Forouzan, Third Edition, TMH
2. Internetworking with TCP/IP Comer 3 rd edition PHI

Reference Books:

1. High performance TCP/IP Networking- Mahbub Hassan, Raj Jain, PHI, 2005
2. Data Communications & Networking – B.A. Forouzan – 2nd Edition – TMH
3. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.

4. Data and Computer Communications, William Stallings, 7th Edition., PEI.
5. The Internet and Its Protocols – Adrian FArrel, Elsevier, 2005.

M.Tech. II Sem. (Elective-II) (ECE)

Multimedia Communications

Course Objectives:

- This course is to provide students with a background in the engineering aspects of Multimedia Communications.
- The course is expected to cover the topics: representation of multimedia information, Information compression , multimedia storage, internet applications, and multimedia communication over networks.

UNIT I

MULTIMEDIA COMMUNICATIONS: Introduction, multimedia networks, multimedia applications.
Multimedia information representation: Introduction, digitization principles, representation of text, images, audio & video.

UNIT II

TEXT & IMAGE COMPRESSION: Various compression principles.
TEXT COMPRESSION: Static Huffmann coding, dynamic Huffman coding, arithmetic coding, Lempel-ziv coding
IMAGE COMPRESSION: Graphics Interchange format, tagged image file format, digitized document, digitized pictures, JPEG (Introduction)

UNIT III

AUDIO & VIDEO COMPRESSION: Audio compression: Differential PCM, Adaptive differential PCM, Code excited LPC, MPEG audio coders, Dolby audio coders.
VIDEO COMPRESSION: Basic principles, Video compression standard H.26 J, h.263, MPEG (Basic introduction)

UNIT IV

INTERNET APPLICATIONS: Domain name system, name structure and administration, DNS resource records, Electronic mail message structure, content transfer, Basic concept of internet telephony, World Wide Web

UNIT V

MULTIMEDIA NETWORKING: Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services-RSVP

Text Books:

- Fred Hulsall, “Multimedia communications”, Pearson Education Asia.
- K. Thakkar, “Multimedia SystemsDesign”, PHI

Reference Books:

- Ralf Stein Metz & Klara Nahrstedt, “Multimedia: Computing, Communications & Applications”, Pearson Education.
- Steve Rimmer, “Advanced Multimedia Programming”,MB!
- Tay Vaughan, “Multimedia: Making it Work”, TMH, 3rd edition.

M.Tech. II Sem. (Elective-II) (ECE)

Optical Communication

Course Objectives:

- **The *objective* of the course is to provide a comprehensive understanding of *optical communication* systems and networks.**

UNIT I

OPTICAL FIBER INTRODUCTION & OPTICAL -MECHANICAL CHARACTERIZATION OF FIBERS,OPTICAL-CABLE DESIGN: Evolution of fiber types, guiding properties of fibers, cross talk between fibers, coupled modes and mode mixing, dispersion properties of fibers, nonlinear properties of optical fibers, SRS, SBS, intensity dependent refractive index,

FIBER DESIGN CONSIDERATIONS: diameter, cladding, thickness, low and high bit rate systems, characterization of materials for fibers, Design objectives and cable structures, fiber splicing, fiber end preparation, single and array splices, measurement of splicing efficiency, optical fiber connectors, connector alignments

UNIT II

OPTICAL SOURCES & DETECTORS:optical sources for communication, LED, injection lasers, modulation technique, direct and indirect methods, optical waveguide devices, Photodiodes in repeaters, receiver design, digital and analog, transmission system design, system design choices, passive and low speed active optical components for fiber system, micro-optic components, lens-less components.

UNIT III

OPTICAL FIBER COMPONENTS: couplers, Isolators and Circulators, Multiplexers, Bragg grating, Fabry-perot Filters, Mach zender interfermometers, Arrayed waveguide grating, tunable filters, hi-channel count multiplexer architectures, optical amplifiers, direct and external modulation transmitters, pump sources for amplifiers, optical switching and wave length converters.

UNIT IV

OPTICAL FIBER TECHNIQUES: Modulation and demodulation, signal formats, direction detection receivers, coherent detection.Optical switching, polarization control, inter office transmission system, trunking system, performance and architecture, under sea cable system, optical fibers in loop distribution system, photonic local network.

UNIT-V

ACCESS NETWORK: Network architecture, HFC, FTTC, optical access network architecture, deployment considerations, upgrading the transmission capacity, SDM, TDM, WDM, application areas, inter exchange, undersea, local exchange networks; Packaging and cabling of photonics components- photonic packet switching, OTDM, multiplexing and demultiplexing,optical logic gates, synchronization, broadcast OTDM network, OTDM testbeds.

Text Books:

1. Gil Held, “Deploying Optical Network Components”.
2. Gerd Kaiser, “Optical Fiber Communication”, McGraw Hill.
3. Rajiv Ramaswamy and Kumar and N. Sivaranjan, “Optical Networks”.

Reference Books:

1. S E Miller, A G Chynoweth, “Optical Fiber Telecommunication”.
2. S E Miller, I Kaninov, “Optical Fiber Telecommunication II”.
3. I Kaninov, T Li, “Optical Fiber Telecommunication IV B”.
4. John. M. Senior, “Optical fiber communications: Principles and Practice”.
5. Govind Agarwal, “Optical Fiber Communications”.

M.Tech. II Sem. (ECE)

COMMUNICATIONS & SIGNAL PROCESSING LAB

Course Objectives:

- To verify the performance of various digital modulation schemes.
- To develop and simulate the various filter designing techniques.

List of Experiments:

1. Simulation Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Dopler Spreads (Ex. 50 Hz and 100 Hz).
2. Generation of Maximal Sequences and Gold Sequences.
3. Design and Simulation FIR Filter Using any Windowing Technique.
4. Design of IIR Filters from Analog Filters.
5. Performance Evaluation of QPSK System over Gaussian AWGN Channel.
6. Performance Evaluation of QPSK System over Rayleigh Fading Channel.
7. Equalization of Multipath Channel using LMS or RLS Algorithms.
8. Performance Evaluation of RAKE Receiver over Slow Fading Channel.
9. Generation of hamming code
10. Generation and detection of Cyclic Redundancy Code