SREE VIDYANIKETHAN ENGINEERING COLLEGE

(AUTONOMOUS)

Sree Sainath Nagar, Tirupati

Department of Electronics and Communication Engineering

Supporting Document for 1.1.2

Syllabus Revision carried out in 2016

Program: M.Tech.- Digital Electronics and Communication Systems

Regulations : SVEC-16

This document details the following:

1. Courses where syllabus has been changed 20% and more.
2. Course-wise revised syllabus with changes highlighted.

Note: *For SVEC-16 revised syllabus, SVEC-14 (previous syllabus) is the reference.*

List of Courses where syllabus content has been changed (20% and more)

S. No.	Course Code	Name of the course	Percentage of content changed	Page Number in which Details are Highlighted
1.	16MT13801	Computer Networks	30	3
2.	16MT13802	Digital Communication Techniques	20	7
3.	16MT13804	Image & Video Processing	100	11
4.	16MT20501	Advanced Computer Architecture	90	13
5.	16MT12541	Soft Computing Techniques	100	17
6.	16MT13806	ASIC Design	100	19
7.	16MT13832	Image & Video Processing Lab	100	21
8.	16MT13808	Research Methodology	100	23
9.	16MT23804	Low Power CMOS VLSI Design	90	25
10.	16MT23809	Speech Processing	100	29
11.	16MT23831	Communications Lab	40	31
12.	16MT23832	Embedded Systems Lab	100	35
13.	16MT23810	Intellectual Property Rights	100	36
		Average %**(A)**	82.31	-
		Total No. of Courses in the Program **(T)**	28	
		No. of Courses where syllabus (more than 20% content) has been changed **(N)**	13	
		Percentage of syllabus content change in the courses **(C)=(A x N)/100**	10.7	
		Percentage of Syllabus Content changed in the Program (P)= C/T	**38.21**	

DEAN (Academics)

DEAN (Academic)
SREE VIDYANIKETHAN ENGINEERING COLLEGE
Sree Sainath Nagar, A. RANGAMPET
CHITTOOR (DT.)-517 102, A.P.

PRINCIPAL

PRINCIPAL
SREE VIDYANIKETHAN ENGINEERING COLLEGE
(AUTONOMOUS)
Sree Sainath Nagar, A. RANGAMPET
Chittoor (Dist.) - 517 102, A.P., INDIA.

M. Tech. - I Semester
(16MT13801) COMPUTER NETWORKS
(Common to DECS & CMS (PE-I))

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --
A Course on Computer Networks and Wireless Communication and Networks at UG Level

COURSE DESCRIPTION:
Advanced computer networks and its architectures; Protocols & Network security; Mobile adhoc networks.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on
   - Architectures and functioning of advanced computer networks like Ethernet, SONET/SDH, Wi-Fi, Frame Relay, ATM networks etc.
   - Protocols like IPv6, MPLS, RSVP, VoIP associated with advanced computer networks.
   - Security features associated with advanced computer networks.
2. Analyze various design issues for conducting research related to the Internet protocol (IP), Wireless LANs and ATM network technologies prominent in high performance scenario.
3. Design and develop techniques for solutions pertaining to the advanced networking technologies.
4. Formulate solutions for engineering problems pertaining to the advanced networking technologies.
5. Initiate research in advanced computer networks.
6. Apply appropriate techniques and tools to complex engineering activities in the field of advanced computer networks.
7. Contribute positively to multidisciplinary scientific research in design and development of Protocols for adhoc network architectures.

DETAILED SYLLABUS

UNIT- I: WIRED AND WIRELESS NETWORKS (10 Periods)
Introduction, Reference models- OSI, TCP/IP; Data Link Control Protocols - HDLC, Point to Point Protocol (PPP); Ethernet- Fast Ethernet, Gigabit Ethernet; Wireless LANS – Merits, topologies, Architecture – Physical Layer, MAC Layer, Frame structure, Applications; Virtual LANs.

UNIT- II: ADVANCED NETWORK ARCHITECTURES (13 Periods)
Circuit switching network - SONET/SDH; Virtual Circuit Networks – Frame Relay, ATM - Protocol Architecture, Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories; Signaling Protocols - MPLS, RSVP; VPN architectures.

UNIT- III: INTERNET TRANSPORT AND APPLICATION PROTOCOLS

(11 Periods)

Internet protocol - IPv6, Transport protocols – Connection Oriented protocol TCP, Connectionless protocol UDP; Congestion control in TCP, Domain Name System, Simple Mail Transfer Protocol, WWW and HTTP, Multimedia Applications – RTP, Voice Over IP.

UNIT- IV: SECURITY IN ADVANCED NETWORKS (10 Periods)

Network security, Cryptography - Symmetric Key Cryptography, Public Key Cryptography, Simple Network Management Protocol, Firewalls - Packet filtering, Digital Signature, IP Security.

UNIT- V: MOBILE AD-HOC NETWORKS (11 Periods)

Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks; Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

Total Periods: 55

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, New Delhi, 4th edition, 2006
2. Nader F. Mir, Computer and Communication Networks, Pearson Education, 4th edition, 2007.
3. William Stallings, "Data and Computer Communication", Prentice hall, 9th edition, 2010

REFERENCE BOOKS:

1. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", Addison Wesley, 4th edition, July 2007.
2. Andrew S. Tanenbaum "Computer Networks", Pearson Education, 4th edition, 2008.

M. Tech. (CMS) – I Semester
M. Tech. (DECS) – I Semester (Elective-I)
(14MT13805) COMPUTER NETWORKS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on Computer Networks at UG Level

COURSE DESCRIPTION:
Protocols & standards of computer and wireless networks; Advanced network architectures; Upper layers protocols; Network security.

COURSE OBJECTIVES:
CEO 1. To impart comprehensive knowledge in understanding the concepts of Networking technologies.

CEO 2. To induce analytical problem solving skills in networking issues.

CEO 3. To apply the knowledge and skills to develop various routing protocols for high speed wired and wireless LAN and WAN technologies that drive towards the development of new applications.

COURSE OUTCOMES: After completion of the course, students should be able to:
CO 1. Acquire in-depth knowledge on
   a. Architectures and functioning of Advanced Wireless LAN and WAN technologies such as Wi-Fi, Wi-Max, Frame Relay, ATM networks etc.
   b. Protocols like MPLS, RSVP, VOIP associated with modern computer network systems.
   c. Know the security features associated with modern computer network systems.

CO 2. Analyze various design issues for conducting research related to the Internet protocol (IP), Wireless LANs and ATM network technologies prominent in high performance scenario.

CO 3. Formulate solutions for engineering problems pertaining to the advanced networking technologies.

CO 4. Apply appropriate techniques and tools to complex engineering activities in the field of computer networks.

DETAILED SYLLABUS

UNIT- I: INTRODUCTION TO COMPUTER NETWORKS (11 Periods)

Data communications & Networking for Today's Enterprise, Data Communications, Network Edge, Network core, Internet, OSI, TCP/IP models, Data Link Control Protocols - HDLC, Point to Point Protocol (PPP);

UNIT- II: WIRELESS NETWORKS (12 Periods)

Ethernet, Fast Ethernet, Gigabit Ethernet, WLANS – Merits and topologies, IEEE 802.11 WLAN Standard – Physical Layer, MAC Layer, Frame structure, IEEE 802.11 a, b, g, e and n standards, Applications; Bluetooth & WiMax- features, standards, protocols and utility; Virtual LANs

UNIT- III: ADVANCED NETWORK ARCHITECTURES (13 Periods)

Circuit switching network - SONET/SDH; Virtual Circuit Networks – Frame Relay, ATM - Protocol Architecture, Logical Connections, ATM Cells, Transmission of ATM Cells, ATM Service Categories; Signaling Protocols - MPLS, RSVP; VPN architectures, IP over ATM, Connecting Devices: Repeaters, Bridges, Routers, Gateways.

UNIT- IV: INTERNET TRANSPORT AND APPLICATION PROTOCOLS (12 Periods)

Internet protocol - IPv6, Transport protocols – Connection Oriented protocol TCP, Connectionless protocol UDP; Congestion control in TCP, Socket interface, Domain Name System, Simple Mail Transfer Protocol, WWW and HTTP, Multimedia Applications – RTP, Voice Over IP.

UNIT- V: SECURITY IN COMPUTER NETWORKS (8 Periods)

Simple Network Management Protocol, Network security, Cryptography - Symmetric Key Cryptography, Public Key Cryptography, Firewalls - Packet filtering, Application Gateway, Digital Signature, IP Sec.

Total Periods: 56

TEXT BOOKS:

4. William Stallings, "Data and Computer Communication", 9th edition, Prentice hall, 2010
5. Behrouz A. Forouzan, "Data Communications and Networking", 4th Ed, Tata McGraw-Hill, New Delhi, 2006
6. Jim Kurose, Keith Ross, "Computer Networking: A Top Down Approach", 4th edition, Addison Wesley, July 2007.

REFERENCE BOOKS:

3. Andrew S. Tanenbaum "Computer Networks", 4th Edition, Pearson Education, 2008
4. LEON-GARCIA, INDRA WIDJAJA, "Communication Networks – Fundamental concepts and Key architectures", TMH, 2000

I M. Tech. – I Semester
(16MT13802) DIGITAL COMMUNICATION TECHNIQUES
(Common to DECS & CMS)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --
Course on Digital Communications at UG Level**,** Review of random Variables and Processes

COURSE DESCRIPTION:
Characterization of Communication Signals and Systems; Digital Modulation Techniques; Optimum Receivers for the Additive Gaussian Noise Channel; Spread Spectrum Technique; Multichannel and Multicarrier Systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Characterization of communication signals and systems.
   - Digital modulation techniques
   - Communication over AWGN channels
   - Optimum receivers
   - Spread spectrum techniques
   - Multi-carrier communication system
2. Analyze numerical and analytical problems critically for conducting research in the field of Digital Communication Systems.
3. Solve engineering problems and arrive at optimal solutions pertaining to digital communications.
4. Apply appropriate techniques to complex engineering activities in the field of signal processing and communications.

DETAILED SYLLABUS:

UNIT I– CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS (10 periods)
Representation of Band Pass Signals and Systems–Representation of Band Pass Signals, Representation of Linear Band-Pass System, Response of a Band-Pass System to a Band-Pass Signal. Signal Space Representations – Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals. Representation of Digitally Modulated Signals – Memory Less Modulation Methods – PAM Signals, Phase Modulated Signals, QAM Signals, Multidimensional Signals, Orthogonal Multidimensional Signals. Spectral Characteristics of Digitally Modulated Signals – Power Spectra of Linearly Modulated Signals.

UNIT II – DIGITAL MODULATION TECHNIQUES (11 periods)
Digital Modulation – Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals. Linear Modulation Techniques – BPSK, DPSK, QPSK, OQPSK, Π/4 QPSK. Constant Envelope Modulation Techniques – MSK, GMSK, Combined Linear and Constant Envelope Modulation Techniques – M-ary PSK, M- ary QAM.

UNIT III – OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL (10 periods)

Optimum Receiver for Signals corrupted by AWGN –Correlation demodulator, Matched Filter Demodulator, Optimum Detector. Performance of the Optimum Receiver for Memory Less Modulation – Probability of Error for Binary Modulation, M-ary Orthogonal Signals, M-ary PAM, M-ary PSK, QAM. Optimum Receiver for Signals with Random Phase in AWGN Channel – Optimum Receiver for Binary Signals, Optimum Receiver for M-ary Orthogonal Signals.

UNIT IV – SPREAD SPECTRUM TECHNIQUES (13 periods)

Introduction, Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals – Introduction, The Processing Gain and Jamming Margin. Applications of Direct Sequence Spread Spectrum Signals – Anti jamming Application, Low-Detectability Signal Transmission, Code Division Multiple Access. Generation of PN-Sequences, Frequency-Hopped Spread Spectrum Signals, Other Types of Spread Spectrum Signals. Detection of spread spectrum signals- Matched filter receiver, RAKE Receiver.

UNIT V –MULTICHANNEL AND MULTICARRIER SYSTEMS (10periods)

Rayleigh and Rician channels, Multichannel Digital Communications in AWGN Channels; Binary Signals, M-ary Orthogonal Signals. Multicarrier Communications; Single Carrier verses Multicarrier Modulation, Capacity of a Non ideal Linear Filter Channel, OFDM, Modulation & Demodulation in an OFDM, An FFT Algorithm Implementation of an OFDM System. OFDMA.

Total Periods: 54

TEXT BOOKS:

1. John G. Proakis, "Digital Communications", McGraw-Hill, 4th edition, 2001.
2. Theodore S. Rappaport, "Wireless Communications", Pearson Education, 2nd edition, 2002.
3. George R. Cooper & Clare D. McGillem, "Modern Communication and Spread Spectrum", McGraw-Hill Book Company, 1986.

REFERENCE BOOKS:

1. Marvin K. Simon, Jim K Omura, Robert A. Scholtz& Barry K.Levit, "Spread Spectrum Communications", McGraw-Hill, 1st edition,1995.
2. J.Marvin, K.Simon, Sami. M.Hinedi and William C. Lindsey, "Digital Communication Techniques", PHI, 2009.

M. Tech. (CMS & DECS)-I Semester
(14MT13802) DIGITAL COMMUNICATION TECHNIQUES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Digital Communications at UG Level

COURSE DESCRIPTION:
Representation of band pass signals and systems; Digital modulation techniques; Design of optimum receivers; Generation and detection of spread spectrum signals.

COURSE OBJECTIVES:

CEO1. To provide advanced knowledge in digital communication over communication channels.

CEO2. To impart design and analytical skills in digital communication systems.

CEO3. To apply the knowledge and skills acquired to the real problems in the field of digital communications.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1. Gain in-depth knowledge in

- Characterization of communication signals and systems.
- Digital modulation techniques
- Communication over AWGN channels
- Optimum receivers
- Spread spectrum techniques

CO2. Analyze numerical and analytical problems critically for conducting research in the field of Digital Communication Systems.

CO3. Solve engineering problems and arrive at optimal solutions pertaining to digital communications.

CO4. Apply appropriate techniques to complex engineering activities in the field of signal processing and communications.

DETAILED SYLLABUS

Review of random Variables and Processes

UNIT–I: CHARACTERIZATION OF COMMUNICATION SIGNALS AND SYSTEMS **[10 Periods]**

Representation of Band Pass Signals and Systems – Representation of Band-Pass Signals, Representation of Linear Band-Pass System, Response of a Band-Pass System to a Band-Pass Signal. Signal Space Representations – Vector Space Concepts, Signal Space Concepts, Orthogonal Expansion of Signals.

Representation of Digitally Modulated Signals – Memory Less Modulation Methods – PAM Signals, Phase Modulated Signals, QAM Signals, Multidimensional Signals, Orthogonal Multidimensional Signals. Spectral Characteristics of Digitally Modulated Signals – Power Spectra of Linearly Modulated Signals.

UNIT–II: DIGITAL MODULATION TECHNIQUES [11 Periods]

Digital Modulation – Factors that Influence the Choice of Digital Modulation, Bandwidth and Power Spectral Density of Digital Signals. Linear Modulation Techniques – BPSK, DPSK, QPSK, OQPSK, ∏/4 QPSK. Constant Envelope Modulation Techniques – MSK, GMSK, Combined Linear and Constant Envelope Modulation Techniques – M-ary PSK, M- ary QAM.

UNIT–III: OPTIMUM RECEIVERS FOR THE ADDITIVE GAUSSIAN NOISE CHANNEL [10 Periods]

Optimum Receiver for Signals Corrupted by AWGN – Correlation Demodulator, Matched Filter Demodulator, the Optimum Detector. Performance of the Optimum Receiver for Memory Less Modulation – Probability of Error for Binary Modulation, M-ary Orthogonal Signals, M-ary PAM, M-ary PSK, QAM. Optimum Receiver for Signals with Random Phase in AWGN Channel – Optimum Receiver for Binary Signals, Optimum Receiver for M-ary Orthogonal Signals.

UNIT–IV: SPREAD SPECTRUM TECHNIQUES [10 Periods]

Introduction, Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals – Introduction, The Processing Gain and Jamming Margin. Applications of Direct Sequence Spread Spectrum Signals – Anti-jamming Application, Low-Detectability Signal Transmission, Code Division Multiple Access. Generation of PN-Sequences, Frequency-Hopped Spread Spectrum Signals, Other Types of Spread Spectrum Signals.

UNIT–V: DETECTION OF SPREAD SPECTRUM SIGNALS [09 Periods]

Coherent Direct-Sequence Receivers, Coherent Carrier Tracking – Delay-Lock Loop Analysis, Tau-Dither Loop. Non Coherent Carrier Tracking, Non coherent Frequency-Hop Receiver, Acquisition of Spread-Spectrum Signals – Acquisition by Cell-By-Cell Searching. Reduction of Acquisition Time – Acquisition with Matched Filters, Matched filters for PN Sequences, Matched Filters for Frequency-Hopped Signals.

Total periods: 50

TEXT BOOKS:

1. John G. Proakis, "Digital Communications", McGraw Hill, 4th edition, 2001.
2. Theodore S. Rappaport, "Wireless Communications", Pearson Education, 2nd edition, 2002.
3. George R. Cooper & Clare D. McGillem, "Modern Communication and Spread Spectrum", McGraw-Hill Book Company, 1986.

REFERENCE BOOKS:

1. Marvin K. Simon, Jim K Omura, Robert A. Scholtz & Barry K.Levit, "Spread Spectrum Communications", Computer Science Press, 1995.
2. J.Marvin, K.Simon, Sami. M.Hinedi and William C. Lindsey, "Digital Communication Techniques", PHI, 2009.

M. Tech. - I Semester
(16MT13804) IMAGE & VIDEO PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on Digital Communications & Digital Signal Processing at UG Level

COURSE DESCRIPTION:
Image Fundamentals and its transforms; image enhancement techniques; Image compression, Image Restoration & Image Segmentation; Video Processing basics like Representation, Sampling, Motion estimation, Filtering and Compression.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Gain in-depth knowledge in
   - Image Transforms
   - Image Enhancement & Restoration Techniques
   - Image Segmentation & Compression Techniques
   - Video Processing
2. Analyze complex engineering problems critically in the domain of Image Processing for conducting research.
3. Solve engineering problems for feasible and optimal solutions in the core area of Image Processing.
4. Initiate research in image and video processing.
5. Apply appropriate tools and techniques to complex engineering activities in the field of Image Processing.
6. Contribute positively to multidisciplinary scientific research in Image Processing.

DETAILED SYLLABUS

UNIT I: FUNDAMENTALS OF IMAGE PROCESSING AND IMAGE TRANSFORMS: (10 Periods)
Fundamental steps in Image Processing, Gray scale and color Images, image sampling and quantization, **2-D Transforms:** DFT, Walsh, Hadamard, Haar, KLT, DCT.

UNIT II: IMAGE ENHANCEMENT & RESTORATION: (10 Periods)
Enhancement: Intensity transformation functions, Filters in spatial and frequency domains, histogram processing, homomorphic filtering.
Restoration: Image Degradation Model, Restoration in presence of noise only- spatial filtering, inverse filtering, Wiener filtering and Constrained least squares filtering.

UNIT III: IMAGE COMPRESSION & IMAGE SEGMENTATION: (13 Periods)
Image compression fundamentals -Redundancies, Compression models: Lossy & Lossless, Arithmetic coding, Bit plane coding, Run length coding, symbol based coding, Transform coding, fidelity criteria.
Segmentation: Fundamentals, Point, line and edge detection, Thresholding, Region based segmentation.

UNIT IV: VIDEO PROCESSING - I (11 Periods)

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling for Analog and Digital Video, Two-Dimensional Rectangular Sampling, Two-Dimensional Periodic Sampling, Sampling on 3-D Structures, Reconstruction from Samples.

UNIT V: VIDEO PROCESSING -II (10 Periods)

Motion Estimation: 2-D Motion vs. Apparent Motion, 2-D Motion Estimation, Methods Using the Optical Flow Equation. Video filtering: motion compensated filtering, noise filtering, restoration, video compression standards.

Total periods: 54

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson Education, 3rd edition, 2008.
2. A. Murat Tekalp, Digital Video Processing, Prentice-Hall, 1995.

REFERENCE BOOKS:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education, 2nd edition, 2002.
2. Anil K. Jain, 'Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.

M. Tech. I-Semester
(16MT20501) ADVANCED COMPUTER ARCHITECTURE
(PE-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PREREQUISITES: *A course on* "Computer Organization".

COURSE DESCRIPTION
Quantitative design and analysis, memory hierarchy design; parallel computer models and network properties; pipelining, superscalar techniques, multiprocessors and multi computers; Multi-Vector, SIMD and Multi-Core computers

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Acquire knowledge of:
   - Computational models and Computer Architectures.
   - Concepts of parallel computer models.
   - Scalable Architectures.
   - Pipelining, Superscalar processors, multiprocessors, SIMD and Multi core Computers.
2. Analyze architectures of parallel computers, sub systems and their interconnection structures.
3. Apply concepts and techniques of advanced computer architectures to solve engineering problems.
4. Conduct investigations, apply appropriate techniques to analyze and interpret data to gain advanced knowledge and solve new problems.

DETAILED SYLLABUS:

UNIT-I: FUNDAMENTALS OF QUANTITATIVE DESIGN AND ANALYSIS, MEMORY HIERARCHY DESIGN (Periods:10)
Fundamentals of Quantitative Design and Analysis: Introduction, Classes of computers, Defining Computer Architecture, Trends in technology, Trends in power and energy in ICs, Trends in cost, Dependability, Quantitative Principles of Computer Design.
Memory Hierarchy Design: Introduction, Advanced optimizations of cache performance, Memory technology and optimizations

UNIT-II: PARALLEL COMPUTER MODELS AND NETWORKS PROPERTIES (Periods:10)
Parallel Computer Models: The state of computing, Multiprocessors and multi-computers, Multi vector and SIMD computers,
P**rogram and Networks Properties:** Conditions of Parallelism, Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures.
Examples: Detection of Parallelism in a program using Bernstein's conditions.

UNIT-III: PRINCIPLES OF SCALABLE PERFORMANCE AND MEMORY (Periods:12)
Principles of Scalable Performance: Performance metrics and measures, Parallel Processing applications, Speedup performance laws.

Bus, Cache and Shared memory: Bus systems, Cache memory organizations, Shared memory organizations.

UNIT-IV: PIPELINING, MULTIPROCESSORS AND MULTICOMPUTERS

(Periods: 12)

Pipelining: Linear pipeline processors, nonlinear pipeline processors, Instruction pipeline design, Arithmetic pipeline design.

Multiprocessors and Multi-computers: Multiprocessor system interconnects, Cache Coherence and synchronization mechanisms.

UNIT-V: MULTI-VECTOR AND SIMD COMPUTERS, MULTI-CORE COMPUTERS

(Periods: 10)

Multi-Vector and SIMD computers: Vector processing principles, Multi-vector multiprocessors, SIMD computer organizations, The Evolution of Dataflow computers Computer Architecture of Warehouse–Scale Computers

Multi-Core computers: Multi-core organization.

Example Architectures: Intel x86 Multi core Organization

Total Periods: 54

TEXT BOOKS:

1. Kai Hwang and Naresh Jotwani, *"Advanced Computer Architecture,"* McGraw-Hill, New Delhi, 2nd edition, 2011.
2. John L. Hennessy and David A. Patterson, *"Computer Architecture-A Quantitative Approach,"* Elsevier, 5th edition, 2012

REFERENCE BOOKS:

1. William Stallings, *"Computer Organization and Architecture-Designing for performance,"* Pearson Education, 9th edition, 2014.
2. Kai Hwang *"Advanced Computer Architecture,"* Tata McGraw-Hill, New Delhi, 1st edition, 2001.

M. Tech. (DECS)-I Semester
(14MT13801) COMPUTER ARCHITECTURES

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
Courses on Digital design and Computer Architecture & Organization at UG level.

COURSE DESCRIPTION:
Basic computer architectural concepts; Instructional and thread level parallelism; Memory design; Multiprocessor interconnection networks.

COURSE OBJECTIVES:
CEO1. To impart advanced knowledge in computer architectures
CEO2. To develop analytical, design and development skills related to architectural features of modern computers.
CEO3. To apply concepts of modern architectural features to promote efficient and cost effective modern processors

COURSE OUTCOMES: After completion of the course, students should be able to:

CO1. Gain potential knowledge relating to
- Instruction level Parallelism
- Memory hierarchy design
- Cache coherency
- Multiprocessor Interconnection Networks

CO2. Gain experience by critically analyzing and evaluating metrics for implementing high performance architectures

CO3. Consider architecture related issues and work together to solve engineering problems towards system architecture choice to meet set of performance goals

CO4. Familiarize with available architectures to overcome ever increasing system design complexity to revolutionize system architectures

DETAILED SYLLABUS

UNIT-I: FUNDAMENTALS OF COMPUTER DESIGN (10 Periods)
Technology trends, Trends in cost, Performance-measuring, reporting and summarization. Quantitative principles of computer design.

UNIT-II: INSTRUCTION LEVEL PARALLELISM (12 Periods)

ILP – Concepts and challenges, Compiler techniques for exposing ILP. Branch prediction - static and dynamic. Dynamic Scheduling, Speculation – Hardware speculation, Techniques, Implementation issues. ILP Limitations.

UNIT-III: MULTIPROCESSORS AND THREAD LEVEL PARALLELISM (12 Periods)

Introduction- Taxonomy of Parallel Architectures, Memory Architecture and Communication models, Parallel Processing Challenges. Symmetric and distributed shared memory architectures, Performance issues, Synchronization, Models of memory consistency.

UNIT-IV: MEMORY HIERARCHY DESIGN (11 Periods)

Introduction- Levels in Memory Hierarchy. Optimizations for Cache Performance, Memory Technology and Optimizations – SRAM, DRAM. Protection- Virtual Memory and Virtual Machines. Design of Memory Hierarchies.

UNIT-V: MULTIPROCESSOR INTERCONNECTION NETWORK (11 Periods)

Interconnection Networks and their Taxonomy, Bus based Dynamic Interconnection Networks, Switch based Interconnection Networks, Static Interconnection Networks, Analysis and Performance Metrics.

Total Periods: 55

TEXT BOOKS:

1. John L. Hennessey and David A. Patterson, "Computer architecture – A quantitative approach", Morgan Kaufmann / Elsevier Publishers, 4th. Edition, 2007.
2. Hesham El-Rewini, Mostafa Abd-El-Barr, "Advanced Computer Architecture and Parallel Processing", A John Wiley & Sons, Inc Publication, 2005.

REFERENCE BOOKS:

1. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture: A hardware/software approach", Morgan Kaufmann /Elsevier Publishers, 1999.
2. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, New Delhi, 2003.

M. Tech. -I Semester
(16MT12541) SOFT COMPUTING TECHNIQUES
(PE-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: --

COURSE DESCRIPTION: Artificial neural network; fuzzy logic; Genetic algorithms and Soft Computing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on :
   - Neural networks and fuzzy logic
   - Genetic algorithms
   - Soft Computing techniques
2. Analyze numerical and analytical problems critically to design fuzzy neural networks.
3. Demonstrate problem solving skills in designing efficient Fuzzy Algorithms.
4. Apply appropriate Genetic techniques to solve problems in the field of soft computing

DETAILED SYLLABUS:

UNIT I INTRODUCTION (Periods: 12)
Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: Cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

UNIT II NEURAL NETWORKS (Periods: 12)
McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

UNIT III FUZZY LOGIC (Periods: 10)
Membership functions: Features, fuzzification, methods of membership value assignments Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT IV GENETIC ALGORITHM (Periods: 10)
Genetic algorithm and search space - general genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multi level optimization – real life problem- advances in GA

UNIT V HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS (Periods: 10)
Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

TEXT BOOKS:

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "*Neuro-Fuzzy and Soft Computing*", PHI / Pearson Education, 2004.
2. S.N.Sivanandam and S.N.Deepa, "*Principles of Soft Computing*", Wiley India Pvt Ltd, 2011.

REFERENCE BOOKS:

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "*Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications*", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, "*Fuzzy Set Theory: Foundations and Applications*" Prentice Hall, 1997.
3. David E. Goldberg, "*Genetic Algorithm in Search Optimization and Machine Learning*" Pearson Education India, 2013.

M. Tech. I-Semester
(16MT13806) ASIC DESIGN
(PE-I)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on VLSI Design at UG Level.

COURSE DESCRIPTION:
ASIC design categories; Design Libraries; Design Entry; Logic Synthesis; Simulation; Testing; Physical design flow of ASIC.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Gain in-depth knowledge in
   - ASIC Design Styles.
   - ASICs Design Libraries.
   - ASICs Design Issues.
   - ASIC Construction.
2. Analyze problems critically in the field of ASIC Design.
3. Design Application Specific ICs for use in various systems.
4. Solve engineering problems and arrive at optimal solutions in pertaining to ASIC Design.
5. Initiate research in ASIC Design.
6. Apply appropriate techniques, resources and tools to engineering activities to provide appropriate Solution for the development of ASICs.
7. Contribute to multidisciplinary scientific work in the field of ASIC Design.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO ASICs (Periods: 10)
Types of ASICs- Full-Custom ASICs, Semicustom ASICs, Standard cell based ASICs, Gate-array based ASICs, Channeled Gate Array, Channel less Gate Array, Structured Gate Array, Programmable Logic Devices, Field-Programmable Gate Arrays, ASIC Design Flow, ASIC Cell Libraries.

UNIT-II: ASIC LIBRARY DESIGN & PROGRAMMABLE ASICs (Periods: 10)
ASIC LIBRARY DESIGN: Transistors as Resistors, Transistor Parasitic Capacitance, Logical Effort, Library cell design, Library Architecture, Gate-Array Design, Standard-Cell Design, Data path-Cell Design.
PROGRAMMABLE ASICs: Anti fuse, Static RAM, EPROM and EEPROM technology, Practical Issues, Specifications.

UNIT-III: LOW-LEVEL DESIGN ENTRY & LOGIC SYNTHESIS (Periods: 12)
LOW-LEVEL DESIGN ENTRY: Schematic Entry, Hierarchical design, The cell library, Names, Schematic Icons & Symbols, Nets, Schematic Entry for ASICs, Connections, Vectored instances and Buses, Edit-in-place, Attributes, Net list Screener, Back-Annotation.
LOGIC SYNTHESIS: A Logic-Synthesis Example**,** Verilog and Logic Synthesis, VHDL and Logic Synthesis, Finite-State Machine Synthesis, Memory Synthesis.

UNIT-IV: SIMULATION, TESTING & ASIC CONSTRUCTION (Periods: 13)

SIMULATION AND TESTING: Types of Simulation -Structural Simulation, Gate-Level Simulation, Static Timing Analysis, Formal Verification, Switch-Level Simulation, Transistor-Level Simulation, Boundary Scan Test, Faults, Fault simulation, Automatic Test-Pattern Generation.

ASIC CONSTRUCTION: Physical Design, System Partitioning, FPGA Partitioning, Partitioning Methods.

UNIT-V: FLOOR PLANNING, PLACEMENT & ROUTING (Periods: 10)

FLOOR PLANNING AND PLACEMENT: Floor planning, Placement, Physical Design Flow, **ROUTING:** Global Routing, Detailed Routing, Special Routing, Circuit Extraction and DRC.

Total Periods: 55

TEXT BOOKS:

1. Micheal John Sebastian Smith, "Application - Specific Integrated Circuits", Addison Wesley Professional, 1997.
2. L. J. Herbst, "Integrated circuit engineering", Oxford University Press, 1996.

REFERENCE BOOKS:

1. Neil H.E. Weste, Kamran Eshraghian, "Principles of CMOS VLSI Design: A Systems Perspective", Addison – Wesley Publication Company, 2nd Edition, 1999.
2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", Wiley, 1st Illustrated Edition, 2002.

M.Tech. – I Semester
(16MT13832) IMAGE & VIDEO PROCESSING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PREREQUISITE:
A course on Image & Video Processing

COURSE DESCRIPTION: Fundamentals of images, image transforms, enhancement, restoration, image compression and coding and video processing.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Demonstrate knowledge in
   - Image Transforms
   - Image Enhancement & Restoration Techniques
   - Image Segmentation & Compression Techniques
   - Video Processing
2. Understand various applications of image processing in industry, Medicine, and defense.
3. Solve engineering problems for feasible and optimal solutions in the core area of Image and video Processing.
4. Initiate research in image and video processing.
5. Acquire an appreciation for the Image and video processing issues and techniques and be able to apply these techniques to real world problems.
6. Contribute positively to multidisciplinary scientific research in Image and video Processing.
7. Communicate effectively in verbal and written forms.

List of Exercises

1. Point processing in spatial domain
   a. Negation of an image
   b. Thresholding of an image
   c. Contrast Stretching of an image
2. Geometric transformations.
   a. Image rotation
   b. Scaling
   c. Translation
3. Logical operations on Digital Image
   a. AND
   b. NAND
   c. OR
   d. NOR
   e. NOT
4. Histogram Equalization and Specification
5. Filtering in spatial domain
   a. smoothing
   b. sharpening
6. Filtering in frequency domain
   a. Low pass filter

b. High pass filter

7. Edge Detection using derivative filter mask
   a. Prewitt
   b. Sobel
   c. Laplacian
8. Image compression using transform techniques.
9. Zooming and shrinking operations on images
10. Morphological operations on images
11. Representation of Digital video: Read, Write, View Videos and conversion of videos in different formats.
12. Video to frame and frame to Video conversion.

Total Time Slots: 12

Required Software Tools:

1. MATLAB with image processing and computer vision tool box

REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3rd edition, Pearson Education, 2008.
2. A. Murat Tekalp, Digital Video Processing, Prentice-Hall, 1995.

M. Tech. – I Semester
(16MT13808) RESEARCH METHODOLOGY
(Common to all M. Tech. Programs)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	-	2	-	-

PREREQUISITES: --

COURSE DESCRIPTION:

Overview of Research, research problem and design, various research designs, data collection methods, statistical methods for research, importance of research reports and its types.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Acquire in-depth knowledge on
   - Research design and conducting research
   - Various data collection methods
   - Statistical methods in research
   - Report writing techniques.
2. Analyze various research design issues for conducting research in core or allied areas.
3. Formulate solutions for engineering problems by conducting research effectively in the core or allied areas.
4. Carryout literature survey and apply research methodologies for the development of scientific/technological knowledge in one or more domains of engineering.
5. Select and Apply appropriate techniques and tools to complex engineering activities in their respective fields.
6. Write effective research reports.
7. Develop attitude for lifelong learning to do research.
8. Develop professional code of conduct and ethics of research.

DETAILED SYLLABUS:

Unit-I: Introduction to Research Methodology (Periods: 5)
Objectives and Motivation of Research, Types of Research, Research Approaches, Research Process, Criteria of good Research, Defining and Formulating the Research Problem, Problem Selection, Necessity of Defining the Problem, Techniques involved in Defining a Problem.

Unit-II: Research Problem Design and Data Collection Methods (Periods: 7)
Features of Good Design, Research Design Concepts, Different Research Designs, Different Methods of Data Collection, Data preparation: Processing Operations, Types of Analysis.

Unit-III: Statistics in Research (Periods: 6)
Review of Statistical Techniques - Mean, Median, Mode, Geometric and Harmonic Mean, Standard Deviation, Measure of Asymmetry, ANOVA, Regression analysis.

Unit-IV: Hypothesis Testing (Periods: 7)

Normal Distribution, Properties of Normal Distribution, Basic Concepts of Testing of Hypothesis, Hypothesis Testing Procedure, Hypothesis Testing: t-Distribution, Chi-Square Test as a Test of Goodness of Fit.

Unit-V: Interpretation and Report Writing (Periods: 3)

Interpretation – Techniques and Precautions, Report Writing – Significance, Stages, Layout, Types of reports, Precautions in Writing Reports.

Total Periods: 28

TEXT BOOK:

1. C.R. Kothari, "*Research Methodology: Methods and Techniques*," New Age International Publishers, New Delhi, 2nd Revised Edition, 2004.

REFERENCE BOOKS:

1. Ranjit Kumar, "*Research Methodology: A step-by-step guide for beginners*," Sage South Asia, 3rd ed., 2011.
2. R. Panneerselvam, "Research Methodology," PHI learning Pvt. Ltd., 2009

M. Tech.- II Semester
(16MT23804) LOW POWER CMOS VLSI DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES:
A Course on VLSI Design at UG Level.

COURSE DESCRIPTION:
Needs For Low Power VLSI Chips; Principles Of Low Power Design; Simulation and Probabilistic Analysis of Low Power; Logic and Circuit Analysis; Special Techniques Of Low Power Design, Performance Management of an Architecture or a System.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:

1. Demonstrate advanced knowledge in
   - Design of logic Circuits for low power Requirements
   - Power Estimation of Analysis
   - Low power architecture & Systems
   - Low Power Techniques
2. Analyze complex problems critically in the domain of low power CMOS Circuit, effects and issues of devices, for conducting research in VLSI Design.
3. Solve engineering problems with wide range of solutions of low power design challenges, tradeoff between area, speed and power requirements.
4. Apply appropriate research methodologies in Low power CMOS devices of complex engineering activities in the field of VLSI Design.
5. Apply appropriate techniques, Resources and tools in, evaluating electrical properties of low power CMOS devices based on second order effects.
6. Contribute positively to multidisciplinary scientific research work in the design and development of Ultra Low power Integrated Circuits suited for wide range of applications.

DETAILED SYLLABUS:

UNIT-I: INTRODUCTION TO LOW POWER VLSI DESIGN (Periods: 10)

Needs For Low Power VLSI Chips, Charging And Discharging Capacitances Short Circuit Current In CMOS, CMOS Leakage Current, Static Current, Basic Principles Of Low Power Design, Low Power Figure Of Merits.

UNIT-II: (Periods: 10)
Simulation Power Analysis:
Spice Circuit Simulation, Discrete Transistor Modeling And Analysis, Gate Level Logic Simulation, Architecture Level Analysis, Data Correlation Analysis, Monto Carlo Simulation.
Probabilistic Power Analysis:
Random Logic Signals, Probability and frequency, Probabilistic Power Analysis Techniques, Signal Entropy.

UNIT-III: (Periods: 15)
Circuit Analysis:

Transistor and Gate Sizing, Equivalent Pin Ordering, Network Restructuring and Reorganization, Special latches and Flip flops, Low Power Digital Cell Library, Adjustable Device threshold Voltage.

Logic Analysis:

Gate Reorganization, Signal Gating, Logic Encoding, State Machine Encoding, Pre computation Logic.

UNIT-IV: SPECIAL TECHNIQUES (Periods: 10)

Power Reduction in Clock Networks, CMOS Floating Node, Low Power Bus, Delay Balancing, Low Power Techniques for SRAM.

UNIT-V: ARCHITECTURE AND SYSTEM (Periods: 10)

Power And Performance Management, Switching Activity Reduction, Parallel Architecture with Voltage Reduction, Flow Graph Transformation.

Total Periods: 55

TEXT BOOK:

1. Gary Yeap, "Practical Low-Power Digital VLSI Design," Springer Publication, 1998.

REFERENCE BOOK:

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley Student Edition, 2000.

M. Tech. (DECS)-I Semester (Elective-I)
(14MT13806) LOW POWER CMOS VLSI DESIGN

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	--	--	4

PRE-REQUISITES:
A Course on VLSI Design at UG Level.

COURSE DESCRIPTION:
Power dissipation and estimation of CMOS circuits; Design, synthesis and testing of low power circuits; Low power static RAM architectures; Energy recovery techniques; Synthesis of low power circuits.

COURSE OBJECTIVES:
CEO1: To impart advanced knowledge in low power CMOS Circuits.

CEO2: To provide design, analytical, logical and development skills in high performance and low power devices.

CEO3: To apply knowledge and skills pertaining to low power VLSI design to solve the real-world problems.

COURSE OUTCOMES: On successful completion of this course the students will be able to

CO1: Gain in-depth knowledge in
- Design of Logic Circuits for High performance and Low Power requirements using CMOS processes.
- Special low power techniques
- Power estimation and analysis
- Low power architecture & Systems.

CO2: Analyze the low power CMOS circuits effects of devices and judge independently the best suited device for fabrication of smart devices for conducting research in ULSI design.

CO3: Solve problems of Low power design challenges, tradeoff between area, speed and power requirements.

CO4: Apply appropriate techniques, resources and tools to engineering activities in low power VLSI circuits.

DETAILED SYLLABUS:

UNIT –I **(Periods: 05)**

Power Dissipation in CMOS VLSI design: Need for low power VLSI chips, Sources of Power dissipation , Power dissipation in MOS & CMOS Devices, Limitations of low Power design.

UNIT –II **(Periods: 12)**

Power Estimation: Modeling of Signals, Signal Probability Calculation, Probabilistic Techniques for Signal activity Estimation, Statistical Techniques, Estimation of Glitching Power, Sensitivity Analysis, Power Estimation using input vector Compaction, Estimation of Maximum Power.

UNIT-III **(Periods: 13)**

Synthesis for Low Power: Behavioral Level Transforms ,Logic Level optimization of low power, Circuit level.

Design and Test of Low Voltage CMOS Circuits: Circuit Design Style, Leakage current in Deep Sub micrometer Transistors, Low voltage Circuit Design Techniques, Multiple Supply Voltages.

UNIT-IV **(Periods: 10)**

Low Power Static RAM Architectures: Organization of Static RAM, MOS Static RAM Memory Cell, Banked Organization of SRAMs, Reducing Voltage Swing in Bit lines, Reducing Power in Sense Amplifier Circuits.

UNIT-V **(Periods: 12)**

Low Energy Computing using Energy Recovery Techniques: Energy Recovery Circuit Design, Designs with partially Reversible logic, Supply Clock Generation.

Software design for low power: Sources of software power dissipation, software power estimation, Software power estimation, Co-design for low power.

Total Periods: 52

TEXT BOOKS:

1. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" WileyStudent Edition,2000.

REFERENCE BOOKS:

1. Kiat-Seng Yeo,Samir S.Rofail and Wang-Ling Goh, "CMOS/BiCMOS ULSI: Low power, Low Voltage ",Pearson education,2002.

M. Tech. - II Semester
(16MT23809) SPEECH PROCESSING
(Common to DECS & CMS)
(PE-II)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	4	-	-	4

PRE-REQUISITES: Courses on Signals & Systems and Digital Signal Processing in UG

COURSE DESCRIPTION:
Acoustic theory of speech production; Models for speech signals and speech processing systems; Mathematical analysis of speech signals - homomorphic and LPC models; Speech and speaker recognition systems.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge in
   - Digital model representation of speech signal
   - LPC analysis
   - Homomorphic models
2. Analyze complex engineering problems critically for conducting research in speech signal processing.
3. Solve engineering problems using efficient algorithms for feasible and optimal solutions in Speech signal processing field.
4. Initiate research in speech signal processing.
5. Apply speech and speaker verification techniques to complex engineering activities in the field of speech processing.
6. Contribute to scientific research in Speech and speaker identification and verification systems with objectivity and rational analysis.

DETAILED SYLLABUS:

UNIT-I: DIGITAL MODEL FOR THE SPEECH SIGNAL (Periods:13)
The process of speech production - the mechanism of speech production, acoustic phonetics. The Acoustic theory of speech production- sound propagation, uniform lossless tubes, Effect of losses in the vocal tract, Effect of radiation at the lips, Vocal tract transfer functions for vowels, the effect of nasal coupling, Excitation of sound in the vocal tract. Digital model for speech signals.

UNIT - II : TIME DOMAIN MODELS FOR SPEECH PROCESSING (Periods:10)
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-III: HOMOMORPHIC SPEECH PROCESSING (Periods:09)
Homomorphic systems for convolution – properties of the complex Cepstrum, computational considerations. The complex Cepstrum of speech, pitch detection, formant estimation, Homomorphic vocoder.

UNIT-IV : LINEAR PREDICTIVE CODING OF SPEECH (Periods:12)

Basic principles of linear predictive analysis – Auto correlation method, The covariance method. Computation of the gain for the model, solution of LPC Equations – Cholesky Decomposition solution for the covariance method. Durbin's Recursive solution for the autocorrelation equations. Comparison between methods of solutions of LPC analysis equations. Applications of LPC parameters – Pitch detection using LPC parameters, Formant analysis using LPC parameters.

UNIT-V: SPEECH AND SPEAKER RECOGNITION SYSTEMS (Periods:08)

Speaker recognition system-speaker verification system, speaker identification systems. Speech recognition system- isolated digit recognition system, continuous digit recognition system, LPC distance measure.

Total periods: 52

TEXT BOOKS:

1. L R Rabiner and SW Schafer, "*Digital processing of speech signals*", Pearson Education, 2006.
2. LR Rabiner, BH Juang, B Yegnanarayana, "*Fundamentals of Speech Recognition*", Pearson Education, 1993.

REFERENCE BOOKS:

1. Thomas F Quateri, "*Discrete time speech signal processing*", Pearson edition, 2006.
2. Ben Gold & Nelson Morgan, "*Speech & audio signal processing*", wiley, 2006.
3. Douglas O Shaughnessy, "*Speech Communications*", Oxford university press, 2nd edition, 2000.

M. Tech. - II SEMESTER
(16MT23831) COMMUNICATIONS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

RE-REQUISITES: Simulation Lab at UG Level

COURSE DESCRIPTION:
Design and simulation of communication systems - QPSK communication system over AWGN channel, Baseband Direct Sequence Spread Spectrum (DS/SS) System; Generation of different density and distribution functions; Generation of maximal and Gold code sequences.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonsrate Knowledge in
   - Generation of Maximal and Gold Sequences & verification of their properties.
   - Design of communication system for band limited channels for Zero ISI.
   - Evaluating the performance of QPSK over AWGN Channel and Rayleigh Fading Channels.
   - Simulation of Code matched filter in Spread Spectrum Communication System.
   - Simulation of baseband Direct Sequence Spread Spectrum (DS/SS) System.
   - Performance evaluation of RAKE Receiver over Slow Fading Channel.
   - Simulation of Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Doppler Spreads.
2. Analyze engineering problems for feasible and optimal solutions in the core area of communication.
3. Design of Matched filter for spread spectrum communications.
4. Use MATLAB Toolbox to simulate complex engineering activities in the field of communication.
5. Demonstrate knowledge and understanding of engineering principles to execute the Projects effectively in the field of communications.

LIST OF EXERCISES:
1. Generation of discrete time independent and identically distributed (IID) random processes with different distributions (Bernoulli, Binomial, Geometric, Poisson, Uniform, Gaussian, Exponential, Laplacian, Rayleigh, Rician). (1 time slot)
2. Communication system Design for Band limited Channels: System design for Zero ISI. (2 time slots)
3. Equalization of Multipath Channel using LMS or RLS Algorithms. (1 time slot)
4. Performance Evaluation QPSK communication system over AWGN channel. (1 time slot)
5. Generation of Maximal sequences & Gold codes and verification of their correlation properties. (2 time slots)
6. Design and simulation of code matched filter in spread spectrum communication system. (1 time slot)
7. Design and simulation of baseband Direct Sequence Spread Spectrum (DS/SS) System. (1 time slot)
8. Simulation of Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Doppler Spreads (Ex. 50 Hz and 100 Hz). (2 time slots)

9. Performance Evaluation of RAKE Receiver over Slow Fading Channel. (2 time slots)
10. Performance Evaluation of QPSK System over Rayleigh Fading Channel. (1 time slots)

Total Time Slots: 14

Tools:

Numerical Computing Environments–GNU Octave or MATLAB or any other equivalent tool

REFERENCE BOOKS:

1. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, *Principles of Communication System Simulation with Wireless Applications,* Pearson, 2004.
2. J.G. Proakis, and M. Salehi, *Contemporary Communication Systems using MATLAB,* Book ware Companion Series, 2006.
3. John G. Proakis, "DIGITAL COMMUNICATIONS", McGraw Hill, 4th edition, 2001.

M. Tech. (DECS)-II Semester

(14MT23821) COMMUNICATIONS AND SIGNAL PROCESSING LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
25	50	75	--	--	4	2

PRE-REQUISITES:
Simulation Lab at UG Level

COURSE DESCRIPTION:
Design of FIR and IIR filters; Equalization of multi path channel; Generation of PN sequences; Performance evaluation of QPSK modulation scheme; Image smoothening and sharpening techniques.

COURSE OBJECTIVES:

CEO1. To design, develop and simulate various components of digital communications and adaptive algorithms.

CEO2. To apply Knowledge and Skills to implement engineering Principles in the field of Communications and Signal processing.

COURSE OUTCOMES:

On successful completion of this course the students will be able to

CO1. Gain skills in

- The generation of Maximal and Gold Sequences
- Design of FIR and IIR filters
- Evaluation of QPSK System
- Equalization of multipath channel using RLS and LMS Algorithms
- The Simulation of Rayleigh fading Channel using Jake's Model
- Performing image Smoothening and Sharpening
- Developing Color image in various color models

for conducting research in the field of Communications and Signal Processing.

CO2. Solve engineering problems for feasible and optimal solutions in the core areas of Communication and Signal Processing.

CO3. Acquire research skills in the domains of Communications and Signal processing.

CO4. Use MATLAB Toolboxes to complex engineering activities in the domains of communication and signal procesing.

CO5. Contribute to multidisciplinary groups in communications and signal processing with objectivity and rational analysis.

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LIST OF EXPERIMENTS:

1. Design and Simulation of FIR Filter Using any Windowing Technique. (1 time slot)

2. Design of IIR Filters from Analog Filters. (1 time slot)

3. Generation of Maximal Sequences and Gold Sequences. (2 time slots)

4. Performance Evaluation of QPSK System over AWGN Channel. (1 time slot)

5. Equalization of Multipath Channel using LMS or RLS Algorithms. (1 time slot)

6. Simulation of Rayleigh Fading Channel Using Either Clarke's Model or Jake's Model for different Doppler Spreads (Ex. 50 Hz and 100 Hz). (2 time slots)

7. Performance Evaluation of RAKE Receiver over Slow Fading Channel. (2 time slots)

8. Performance Evaluation of QPSK System over Rayleigh Fading Channel. (2 time slots)

9. Smoothening & Sharpening of a given image. (1 time slot)

10. Color image in various color models. (1 time slot)

TOOLS REQUIRED: MATLAB with Communication, Signal and image Processing Tool Boxes.

REFERENCES:

1. Communications and Signal Processing Lab Manual of the Department.

2. W.H. Tranter, K. Sam Shanmugham, T.S. Rappaport, and K.L. Kosbar, "Principles of Communication System Simulation with Wireless Applications*,"* Pearson, 2004.

3. J.G. Proakis, and M. Salehi, "Contemporary Communication Systems using MATLAB and Simulink *,"* Cengage learning, 2nd Edition, 2004.

4. R.C. Gonzalez, R. E. Woods, Steven L.Eddins, "Digital Image Processing using MATLAB, Gatesmark Publishing, 2 nd Edition, 2009

M. Tech. – II Semester
(16MT23832) EMBEDDED SYSTEMS LAB

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
50	50	100	-	-	4	2

PRE-REQUISITES: Digital Logic Design, C-Programming, Embedded System Design Courses at UG Level

COURSEDESCRIPTION: MSP430 Programming; Timers; Interrupts; Parallel and Serial Ports; ADC; SPI; Applications

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate knowledge in on-chip resources available in MSP430 Based microcontrollers such as: Parallel Ports, Timers, ADC, Serial ports.
2. Analyze critically various on-chip resources, programming alternatives towards efficient system design.
3. Solve complex engineering problems in embedded domain.
4. Design embedded systems using microcontrollers such as the MSP430.
5. Initiate research in embedded system design.
6. Contribute positively to multidisciplinary scientific research in Embedded domain.
7. Communicate effectively in verbal and written forms.

List of Experiments:

1. Study of MSP430 based Development Environment (1 Slot)
2. Read input from switch and Automatic control/flash LED (software delay)(1 Slot)
3. Digital input and Output using parallel ports (1 Slots)
4. Watchdog timer as interval Timer (1 Slots)
5. Timer Application: Measurement in capture mode and output in continuous mode (2 Slots)
6. Setting real time clock: state machines (1 Slots)
7. Configuring and usage of interrupts (1 Slot)
8. Measurement of frequency (1 slot)
9. Generation of precise frequency (1 Slot)
10. PWM Generator (1 Slot)
11. SPI with USI and USCI (2 Slots)
12. ADC (1 Slot)

Total Time Slots: 14

TEXT BOOK:

1. Chris Nagy, "Embedded Systems Design using the TI MSP430 Series", Embedded Technology Series, Newness Imprint, Elsevier Publications, 2003

REFERENCE BOOK:

1. John Davies, "MSP430 Microcontroller Basics", Newness Imprint, Elsevier Publications, 1st edition, Aug. 2008

M. Tech. – II Semester
(16MT23810) INTELLECTUAL PROPERTY RIGHTS
(Common to all M. Tech. Programs)
(Audit Course)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
-	-	-	-	2	-	-

PRE-REQUISITES: --

COURSE DESCRIPTION:

Introduction to Intellectual Property; Trade Marks; Law of Copy Rights; Law of Patents; Trade Secrets; Unfair Competition; New Development of Intellectual Property.

COURSE OUTCOMES:
After successful completion of the course, students will be able to:
1. Demonstrate in-depth knowledge on
   - Intellectual Property
   - Trade Marks & Secrets
   - Law of Copy Rights, Patents
   - New development of Intellectual Property
2. Analyze the different forms of infringement of intellectual property rights.
3. Solve problems pertaining to Intellectual Property Rights.
4. Stimulate research zeal for patenting of an idea or product.
5. Write effective reports required for filing patents.
6. Develop life-long learning capabilities.
7. Develop awareness of the relevance and impact of IP Law on their academic and professional lives.
8. Develop attitude for reflective learning.

DETAILED SYLLABUS:

UNIT - I: Introduction to Intellectual property (Periods:5)
Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II: Trade Marks: (Periods:5)
Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT - III: Law of copy rights: (Periods:6)
Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.
Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT - IV: Trade Secrets: (Periods:6)
Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.
Unfair competition: Misappropriation right of publicity, False advertising.

UNIT - V: New development of intellectual property: (Periods:6)

New developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

Total Periods: 28

REFERENCE BOOKS:

1. Deborah, E. Bouchoux, *Intellectual property right*, Cengage learning.
2. Prabuddha ganguli, *Intellectual property right - Unleashing the knowledge economy*, Tata Mc Graw Hill Publishing Company Ltd.