### SEMESTER – I

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SEMESTER – IV

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**Program Elective – 1**
1. Random Processes and Queuing Theory
2. Bio-Medical Signal Processing
3. Advanced Data Communications
4. Detection and Estimation Theory

**Program Elective - 2**
1. Digital Signal Processors and Architectures
2. Radar Signal Processing
3. VLSI Signal Processing
4. TCP/IP and ATM Networks

**Program Elective – 3**
1. Image and Video Processing
2. Pattern Recognition and Machine Learning
3. Coding Theory and Techniques
4. Speech and Audio Signal Processing

**Program Elective – 4**
1. Communication Technologies
2. Spread Spectrum Communications
3. Adhoc and Wireless Sensor Networks
4. Multimedia and Signal Coding

**Program Elective – 5**
1. High Performance Networks
2. Software Defined Radio
3. Soft Computing Techniques
4. RF Circuit Design

**Open Elective**
Principles of Signal Processing
TRANSFORM TECHNIQUES

M.Tech, SSP. I-Sem L T P C
3 0 0 3

Prerequisite: None

Course Objectives
1. To learn basics of two dimensional transform.
2. Understand the various two dimensional transform definition, properties and applications.
3. Understand the design of filter Bank structure.
4. To learn the fundamentals of wavelet transform and special wavelets.

Course Outcomes
On completion of this course student will be able to:
1. The student will learn basics of two dimensional transforms.
2. Understand the definition, properties and applications of various two dimensional transform.
3. Understand the basic concepts of wavelet transform.
4. Understand the special topics such as wavelet packets, Bi-orthogonal wavelets e.t.c.

UNIT -I
Fourier Analysis: Vector space, Hilbert spaces, Fourier basis, FT- Limitations of Fourier Analysis, Need for time-frequency analysis, DFT, 2D-DFT: Definition, Properties and Applications, IDFT, Hilbert Transform, STFT.

UNIT -II
Transforms: Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT,– definition, properties and applications

UNIT -III

UNIT -IV
Multi Rate Analysis and DWT: Need for Scaling function – Multi Resolution Analysis, Two-Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

UNIT -V
Special Topics: Wavelet Packet Transform, Multidimensional Wavelets, Bi-orthogonal basis- B-Splines, Lifting Scheme of Wavelet Generation, Multi Wavelets

TEXT BOOKS
REFERENCES

Advanced Digital Signal Processing

M.Tech, SSP. I-Sem

Course Objectives
The objectives of this course are to:
1. Understand the implementation of digital filters using various structures and study the advantages & disadvantages of implementation structures.
2. Study various parametric and non-parametric methods of power spectrum estimation.
3. Understand the effects of finite word length in hardware implementation of IIR filters and FFT.
4. Understand the concepts of Multirate signal Processing and their applications.

Course Outcomes
On completion of this course student will be able to:
1. Implement a filter in various forms.
2. Estimate the power spectrum of signal corrupted by noise using Non-Parametric or Parametric methods.
3. Understand finite word length effects in IIR filters and FFT.
4. Implement Multirate systems and understand the applications of Multirate signal processing.

UNIT – I
Review of DFT, FFT, IIR Filters and FIR Filters: Introduction to filter structures (IIR & FIR), Implementation of Digital Filters, specifically 2nd Order Narrow Band Filter and 1st Order All Pass Filter, Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures.

UNIT – II
Non-Parametric Methods: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods

UNIT - III

UNIT – IV
Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion. Examples of up-sampling using an All Pass Filter.

UNIT – V
TEXT BOOKS
2. Discrete Time signal processing - Alan V Oppenheim & Ronald W Schauffer, PHI.

REFERENCES
RANDOM PROCESSES AND QUEUING THEORY
(PE-1)

M.Tech, SSP. I-Sem

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Prerequisite: Probability Theory & Stochastic Processes

Course Objectives
The main objectives of the course are:
1. To explore in the random process and queuing theory useful for Computer and communication Networks.
2. Understand Random variables as an intrinsic need for the analysis of random phenomena.
3. To understand the modeling of telecommunication networks using appropriate queuing process.
4. To know the need of Markov chains and queuing theory in communication networks.

Course Outcomes
Students will be able to:
1. Evaluate and apply moments and Characteristics functions.
2. Understand the concept of random process spectral density of stationary process.
3. Understand the concepts of Markov Chains and queuing theory.
4. Understand the concepts of M|M|1, M|M|1|K, M|G|1 queuing Process.

UNIT I
Random Variable
Random Variables-Basic Definitions and properties, Sum of independent random variables, Minimum and Maximum of random variables, Comparisons between random variables, Moments of the random variables, Random variables in the field of telecommunications, Transformations of random variables- The probability generating function, the characteristic function of a pdf, The Laplace Transform of a pdf, Methods for the generation of random variables- Method of the inverse of the distribution function, Method of the transformation.

UNIT II
Random Processes

UNIT III
Markov Chains and Queuing Theory
Queues, Poisson arrival process- Sum of independent Poisson processes, Random splitting of a Poisson process, Compound Poisson processes, Birth death Markov chains, Formulation of Hidden Markov Model (HMM), building, evaluation and decoding of HMM, Notations for Queuing systems, The Little Theorem, M/M/1 queue analysis, M/M/1/K queue analysis, M/M/S queue analysis, M/M/S/S queue analysis, The M/M/∞ queue analysis, Distribution of the queuing delays in the FIFO case- M/M/1 case, M/M/S case.
UNIT IV
M/G/1 Queuing Theory
M/G/1 queue, M/G/1 system delay distribution in the FIFO case, Laplace Transform numerical inversion method, Generalizations of the M/G/1 theory, Different imbedding instants in the M/G/1 theory, M/G/1 with geometrically distributed messages.

UNIT V
Local Area Network Analysis

TEXTBOOKS

REFERENCES
BIOMEDICAL SIGNAL PROCESSING
(PE-1)

M.Tech, SSP. I-Sem

Prerequisite: Advanced Digital Signal Processing

Course Objectives
The main objectives of the course are:
1. To use basic probability theory to model random signals in terms of Random Processes.
2. To understand various cardiological signal processing techniques and noise cancellation techniques.
3. To understand estimation of signals using Prony’s and least square and linear prediction methods.
4. To comprehend EEG signals, modeling and sleep stages.

Course Outcomes
After studying the course, each student is expected to be able to:
1. Use probability theory to model random processes.
2. Compare various lossless and lossy data compression techniques.
3. Compare various ECG processing and noise cancellation techniques.
4. Model and estimate EEG signals and various sleep stages.

UNIT -I

UNIT -II
Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Huffman coding, vector quantisation, DICOM Standards

UNIT -III

UNIT -IV

UNIT -V
TEXT BOOKS

REFERENCES
ADVANCED DATA COMMUNICATIONS
(PE – 1)

M.Tech, SSP. I-Sem

Prerequisite: Digital Communication

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

Course Outcomes
At the end of the course, the student will be able to:
1. Understand the concepts of Networks and data link layer.
2. Acquire the knowledge of error detection, forward and reverse error correction techniques.
3. Compare the performance of different MAC protocols like Aloha, CSMA, CSMA/CA, TDMA, FDMA & CDMA.
4. Understand the significance of Switching circuits and characteristics of Wired LANs

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

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

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

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

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

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

Wired LANS
Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Giga bit Ethernet
UNIT IV
Switching
Introduction to Switching, Circuit Switched Networks, Packet Switching, Structure of switch
Multiplexing
Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing.
Spectrum Spreading
Spread Spectrum-Frequency Hopping Spread Spectrum and Direct Sequence Spread Spectrum
Connecting devices
Passive Hubs, Repeaters, Active Hubs, Bridges, Two Layer Switches, Routers, Three Layer Switches, Gateway, Backbone Networks.

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

TEXT BOOKS

REFERENCES
DETECTION AND ESTIMATION THEORY
(PE-1)

M.Tech, SSP. I-Sem

Prerequisite: Probability Theory and Stochastic Processes

Course Objectives
The main objectives of the course are:
1. The main objective of this course is to provide basic estimation and detection background for engineering applications.
2. This course provides the main concepts and algorithms for detection and estimation theory.
4. To apply estimation methods for real time engineering problems.

Course Outcomes
On completion of this course student will be able to
1. Understand the basic Random Process and detection methods.
2. Known the significance of Probability of error
3. Learn about basic estimation methods and filters
4. Measure the statistical parameters for random processes

UNIT –I
Random Processes
Discrete Linear Models, Markov Sequences and Processes, Point Processes, and Gaussian Processes.

UNIT –II
Detection Theory
Basic Detection Problem, Maximum A posteriori Decision Rule, Minimum Probability of Error Classifier, Bayes Decision Rule, Multiple-Class Problem (Bayes)- minimum probability error with and without equal a priori probabilities, Neyman-Pearson Classifier, General Calculation of Probability of Error, General Gaussian Problem, Composite Hypotheses.

UNIT –III
Linear Minimum Mean-Square Error Filtering
Linear Minimum Mean Squared Error Estimators, Nonlinear Minimum Mean Squared Error Estimators. Innovations, Digital Wiener Filters with Stored Data, Real-time Digital Wiener Filters, Kalman Filters.

UNIT –IV
Statistics

UNIT –V
Estimating the Parameters of Random Processes from Data
TEXT BOOKS


REFERENCES

2. Introduction to Statistical Signal Processing with Applications – Srinath, Rajasekaran, Viswanathan, 2003, PHI.
DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES  
(PE- 2)

M.Tech, SSP. I Sem  

L T P C  
3 0 0 3

Prerequisite: Digital Signal Processing

Course Objectives
The main objectives of the course are:
1. To provide a comprehensive understanding of various programs of Digital Signal Processors.  
2. To distinguish between the architectural differences of ARM and DSPs along with floating point capabilities.  
3. To explore architecture and functionality of various DSP Processors and can able to write programs.  
4. To known about the connectivity of interfacing devices with processors.

Course Outcomes
Upon completing this course, the student will be able to:  
1. Understand the various processing operations on Digital signals.  
2. Know the architecture of DSP Processors TMS320C54XX, ADSP 2100, 2181 and Blackfin Processor.  
3. Run the programs on DSP Processors.  
4. Interface Memory and I/O devices with DSP Processors.

UNIT –I  
Fundamentals of Digital Signal Processing
Digital signal-processing system, Sampling process, Discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and Interpolation, 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, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors.

UNIT –IV  
Analog Devices Family of DSP Devices
Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor. Introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals
UNIT – V  
**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).

TEXT BOOKS


REFERENCES

RADAR SIGNAL PROCESSING
(PE-2)

M.Tech, SSP. I Sem

Prerequisite: Radar Systems

Course Objectives
The main objectives of the course are:
1. This course emphasis on the principles of Radar Systems and Signal Processing techniques.
2. Ability to understand the various parameters of Radar like pdf, prf.
3. Acquire knowledge about pulse compression Radar.
4. To study the phase coding Techniques.

Course Outcomes
Upon the completion of this course, the student will be able to
1. Understand the principles of Radar Systems.
2. Learn the appropriate model, calculate system performance parameters and assess the limitations of particular systems.
3. Understand the concepts of pulse compression Radar.

UNIT -I
Introduction

UNIT –II
Radar Equation

UNIT –III
Waveform Selection

UNIT -IV
Pulse Compression in Radar Signals
Introduction, Significance, Types, Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Side lobes, Stretch Techniques, Generation and Decoding of FM Waveforms.

UNIT –V
Phase Coding Techniques
Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar.

TEXT BOOKS
REFERENCES

VLSI SIGNAL PROCESSING
(PE- 2)

M.Tech, SSP. I Sem

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Prerequisite: VLSI Technology, Digital Signal Processing

Course Objectives
The objectives of this course are to:
1. Introduce techniques for the existing DSP structures to suit VLSI implementations.
2. Introduce efficient design of DSP architectures suitable for VLSI.
3. Understand various fast convolution techniques.
4. Understand low power processors for signal processing and wireless applications

Course Outcomes
On successful completion of the module, students will be able to:
1. Ability to modify the existing or new DSP architectures suitable for VLSI.
2. Understand the concepts of folding and unfolding algorithms and applications.
3. Ability to implement fast convolution algorithms.
4. Low power design aspects of processors for signal processing and wireless applications.

UNIT -I
Introduction to DSP
Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms

Pipelining and Parallel Processing
Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power

Retiming
Introduction, Definitions and Properties, Solving System of Inequalities, Retiming Techniques

UNIT –II
Folding and Unfolding
Folding- Introduction, Folding Transform, Register minimization Techniques, Register minimization in folded architectures, folding of Multirate systems
Unfolding- Introduction, An Algorithm for Unfolding, Properties of Unfolding, critical Path, Unfolding and Retiming, Applications of Unfolding

UNIT -III
Systolic Architecture Design
Introduction, Systolic Array Design Methodology, FIR Systolic Arrays, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design, Systolic Design for Space Representations contain Delays.

UNIT -IV
Fast Convolution
Introduction – Cook-Toom Algorithm – Winogard algorithm – Iterated Convolution – Cyclic Convolution – Design of Fast Convolution algorithm by Inspection
UNIT -V
Low Power Design
Scaling Vs Power Consumption, Power Analysis, Power Reduction techniques, Power Estimation Approaches

Programmable DSP

TEXT BOOKS

REFERENCES
TCP/IP AND ATM NETWORKS
(PE- 2)

M.Tech, SSP. I Sem

Prerequisite: Computer Networks

Course Objectives
The main objectives of the course are:
1. To study Network Layer Protocols, Next Generation IP protocols
2. To learn about User Datagram Protocol, Transmission Control Protocol and stream control
   Transmission protocol.
3. To understand techniques to improve QoS
4. To learn about Transport Layer Protocols for Ad Hoc Wireless Networks
5. To study the features of ATM networks and various Interconnection Networks

Course Outcomes
At the end of the course, the student will be able to:
2. Understand and analyze about UDP, TCP AND SCTP protocols, flow and error control
   techniques.
3. Learn congestion control mechanisms and techniques to improve Quality of Service in switched
   networks
4. To understand the performance of TCP in Ad-hoc networks and various modified versions of
   TCP in ad-hoc networks
5. To understand features of Virtual circuit networks like ATM networks and their applications
   Design and analyze various types of Inter connection Networks,

UNIT I
Network Layer
Network Layer Services, Packet switching, , Network Layer Performance, IPv4 Addresses, Internet
protocol(IP), ICMP v4, IPv6 Addressing, IPv6 protocol, ICMPv6 protocol, Transition from IPv4to
IPv6,Mobile IP
Forwarding of IP Packets, Delivery- Direct Versus Indirect Delivery, Forwarding- Forwarding
Techniques, Forwarding Process, Routing Table, Unicast routing- Routing algorithms, Unicast
routing protocols, Multicast routing, Multicasting basics.

UNIT II
Transport Layer
Introduction to Transport Layer, Transport layer services, Connectionless Versus Connection
Protocol, Selective Repeat Protocol, Bidirectional Protocols: Piggybacking Transport layer protocols
Services and Port Numbers.
UDP, TCP and SCTP
User Datagram Protocol (UDP)
User Datagram, UDP Services, UDP Applications
Transmission Control Protocol (TCP)
TCP Services, TCP Features, Segments, TCP Connection, State Transition Diagram, Windows in TCP,
Flow and Error Control, TCP Timers,
SCTP: SCTP Services, SCTP Features, Packet Format, An SCTP Association SCTP Flow and Error
Control
UNIT III  
**Traditional TCP**  
Congestion Control, Additive Increase Multiplicative Decrease (AIMD), Slow Start, Fast recovery, fast retransmit  

**TCP in Wireless Domain**  
Traditional TCP, TCP over wireless, Snoop TCP, TCP-Unaware Link Layer Indirect TCP, Mobile TCP, Explicit Loss Notification, WTCP, TCP SACK, Transaction-Oriented TCP  

**Transport Layer Protocols for Ad Hoc Wireless Networks**  
TCP Over Ad Hoc Wireless Networks- Feedback-Based TCP, TCP with Explicit Link Failure Notification, TCP-Bus, Ad Hoc TCP, Split TCP.  

UNIT IV  
**Congestion Control and Quality of Service**  

**Queue Management**  
Passive-Drop trial, Drop front, Random drop, Active- early Random drop, Random Early detection.  

UNIT V  
**ATM Networks**  
ATM-Design Goals, Problems, Architecture, Switching, ATM Layers  

**SONET/SDH**  
Architecture, SONET Layers, SONET Frames, STS Multiplexing, SONET Networks  

**Interconnection Networks**  
Introduction, Banyan Networks, Properties, Crossbar switch, Three stage Class Networks, Rearrangeable Networks, Folding algorithm, Benes Networks, Lopping algorithm, Bit allocation algorithm.  

TEXT BOOKS  

REFERENCES  
SIGNAL PROCESSING LAB

M.Tech, SSP. I Sem                                             L    T     P   C
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Note:

A. Minimum of 10 Experiments have to be conducted

1. Basic Operations on Signals, Generation of Various Signals and finding its FFT.
2. Program to verify Decimation and Interpolation of a given Sequences.
3. Program to Convert CD data into DVD data
4. Generation of Dual Tone Multiple Frequency (DTMF) Signals
5. Plot the Periodogram of a Noisy Signal and estimate PSD using Periodogram and Modified Periodogram methods
6. Estimation of Power Spectrum using Bartlett and Welch methods
7. Verification of Autocorrelation Theorem
8. Parametric methods (Yule-Walker and Burg) of Power Spectrum Estimation
9. Estimation of data series using Nth order Forward Predictor and comparing to the Original Signal
10. Design of LPC filter using Levinson-Durbin Algorithm
11. Computation of Reflection Coefficients using Schur Algorithm
12. To study Finite Length Effects using Simulink
13. ECG signal compression
14. Design and verification of Matched filter
15. Adaptive Noise Cancellation using Simulink
16. Design and Simulation of Notch Filter to remove 60Hz Hum/any unwanted frequency component of given Signal (Speech/ECG)
SCRIPTING LANGUAGES LAB

M.Tech, SSP. II-Sem

Prerequisites: Students should install Python on Linux platform.

List of Programs

Part: I

Preliminary Exercises:

1. To demonstrate different number data types in Python.
2. To perform different Arithmetic Operations on numbers in Python.
3. To create, concatenate and print a string and accessing sub-string from a given string.
4. Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”
5. To demonstrate working with dictionaries in python.
6. To find largest of three numbers.
7. Write a Python program to construct the a pattern, using a nested for loop.
8. Write a Python script that prints prime numbers less than 20.
9. To convert temperatures to and from Celsius, Fahrenheit.

Part: II

10. To create, append, and remove lists in python.
11. To demonstrate working with tuples in python.
12. To find factorial of a number using Recursion.
13. Write a Python class to implement pow(x, n)
14. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.
15. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
16. Write a Python class to find the frequency of each alphabet (of any language) in the given text document.
Course Objectives
1. Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
2. Follow research related information
3. Understanding that when IPR would take such important place in growth of individuals and nation, it is needless to emphasis the need of information about intellectual Property Right to be promoted among students in general & engineering in particular.
4. Understand that IPR protection leads to economic growth and social benefits

Course Outcomes
At the end of this course, students will be able to
1. Understand research problem formulation.
2. Analyze research problem formulation.
3. Understand the IPR protection provides incentive top inverters for further research work and investment in R & D.
4. Understand that IPR protection leads to creation of new and better products.

UNIT I

UNIT II
Data collection, analysis, interpretation, necessary instrumentations, Effective literature studies approaches, analysis Plagiarism, and Research ethics

UNIT III
Effective technical writing, how to write report, paper, Developing a research proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT IV
Nature of Intellectual property
Patents, Designs, Trade, Copyright, copy left, copy right, creative commence, Process of Patenting and Development - technological research, innovation, patenting, development. International Scenario- International cooperation on intellectual property, Procedure for grants of patents, Patenting under PCT.

UNIT V
Patents Rights
Scope of Patents Rights, Licensing and transfer of technology, Patents information and databases, Geographical Indications, Administration of Patent System, New developments in IPR - IPR of Biological Systems, Computer Software etc., Traditional Knowledge Case Studies.
REFERENCES

ADAPTIVE SIGNAL PROCESSING

M.Tech, SSP. II-Sem

Prerequisite: Digital Signal Processing

Course Objectives
The main objectives of the course are:
1. This course focuses on problems algorithms and solutions for processing signals in an manner that is responsive to a changing environment.
2. To develop systems on recursive, model based estimation methods taking the advantage of the statistical properties of the received signals.
3. To analyze the performance of adaptive filters and considers the application of the theory to a variety of practical problems such as beam forming and echo cancellation signal.
4. To understand innovation process, Kalman filter theory and estimation of state using the innovation process, concept of Kalman Gain and Filtering.

Course Outcomes
After studying the course, the student is expected to be able to:
1. Design and apply optimal minimum mean square estimators and in particular linear estimators.
2. Understand and compute their expected performance and verify it.
3. Design, implement and apply Wiener Filters (FIR, non-casual, causal) and evaluate their performance.
4. To understand innovation process, Kalman filter theory and estimation of state using the Innovation Process, concept of Kalman Gain and Filtering.
5. Design, implement and apply LMS, RLS and Kalman filters to given applications.

UNIT –I
Introduction to Adaptive Systems

UNIT –II
Development of Adaptive Filter Theory & Searching the Performance surface

UNIT –III
Steepest Descent Algorithms

UNIT –IV
LMS Algorithm & Applications
UNIT –V
Kalman Filtering

TEXT BOOKS

REFERENCES
WIRELESS COMMUNICATIONS AND NETWORKS

M.Tech, SSP. II-Sem

L T P C
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Prerequisite: Digital Communications

Course objectives
The course objectives are:
1. To provide the students with the fundamental treatment about many practical and theoretical concepts that forms basic of wireless communications.
2. To equip the students with various kinds of wireless networks and its operations.
3. To provide an analytical perspective on the design and analysis of the traditional and emerging wireless networks, and to discuss the nature of, and solution methods to, the fundamental problems in wireless networking.
4. To train students to understand the architecture and operation of various wireless wide area networks such as GSM, IS-95, GPRS and SMS.

Course Outcomes
Upon completion of the course, the student will be able to:
1. Understand cellular system design concepts.
2. Analyze various multiple access schemes used in wireless communication.
3. Demonstrate wireless Local and Wide area networks and their specifications.
4. Familiar with some of the existing and emerging wireless standards.
5. Understand the concept of orthogonal frequency division multiplexing.

UNIT -I
The Cellular Concept-System Design Fundamentals

UNIT –II
Mobile Radio Propagation: Large-Scale Path Loss

UNIT –III
Mobile Radio Propagation: Small –Scale Fading and Multipath
Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small-Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath
Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small-Scale Fading—Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread—Fast fading, slow fading, Statistical Models for multipath Fading Channels—Clarke’s model for flat fading, spectral shape due to Doppler spread in Clarke’s model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT -IV
Equalization and Diversity

UNIT -V
Wireless Networks
Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a, b, g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

TEXT BOOKS

REFERENCES
1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
IMAGE AND VIDEO PROCESSING
(PE – 3)

M.Tech, SSP. II-Sem

Prerequisite: Digital Signal Processing

Course Objectives
1. The student will be able to understand the quality improvement methods of Image.
2. To study the basic digital image and video filter operations.
3. Understand the fundamentals of Image Compression.

Course Outcomes
On completion of this course student will be able to
1. Learn the image representation, and fundamental processing steps of an image.
2. Know the different enhancement techniques in both spatial and frequency domains.
3. Understand the importance of compression and different compression techniques.
4. Learn the representation, modeling and motion estimation of Video.

UNIT – I
Fundamentals of Image Processing and Image Transforms
Basic steps of Image Processing System Sampling and Quantization of an image, Basic relationship between pixels.
Image Segmentation
Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region based segmentation.

UNIT – II
Image Enhancement
Spatial domain methods: 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, Selective filtering.

UNIT – III
Image Compression
Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, , Bit plane coding, Transform coding, Predictive coding, Wavelet coding, Lossy Predictive coding, JPEG Standards.

UNIT - IV
Basic Steps of Video Processing

UNIT – V
2-D Motion Estimation
Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.
TEXT BOOKS

REFERENCE BOOKS
PATTERN RECOGNITION AND MACHINE LEARNING  
(PE - 3)

M.Tech, SSP. II-Sem                                           L   T    P   C
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Prerequisite: NIL

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

Course Outcomes
On completion of this course student will be able to
1. Learn the basics of pattern classes and functionality.
2. Construct the various linear models.
3. Understand the importance kernel methods.
4. Learn the Markov and Mixed models.

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

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

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

UNIT-IV
Graphical Models
Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence - Three example graphs, D-separation, Markov Random

UNIT-V
Mixture Models and EM algorithm

TEXT BOOKS

REFERENCES
CODING THEORY AND TECHNIQUES  
(PE - 3)

M.Tech, SSP. II-Sem  

Prerequisite: Digital Communications  

Course Objectives  
1. To acquire the knowledge in measurement of information and errors.  
2. To study the generation of various code methods.  
3. To study the various application of codes.  

Course Outcomes  
On completion of this course student will be able to  
1. Learning the measurement of information and errors.  
2. Obtain knowledge in designing Linear Block Codes and Cyclic codes.  
3. Construct tree and trellies diagrams for convolution codes  
4. Design the Turbo codes and Space time codes and also their applications  

UNIT – I  
Coding for Reliable Digital Transmission and storage  
Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.  

Linear Block Codes  
Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system  

UNIT - II  
Cyclic Codes  
Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.  

UNIT – III  
Convolutional Codes  
Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.  

UNIT – IV  
Turbo Codes  
LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding
UNIT - V
Space-Time Codes
Introduction, Digital modulation schemes, Diversity, Orthogonal space-Time Block codes, Alamouti’s schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing : General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation, Performance of Multi-Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

TEXT BOOKS

REFERENCES
1. Digital Communications-Fundamental and Application - Bernard Sklar, PE.
SPEECH AND AUDIO SIGNAL PROCESSING  
(PE-3)

M.Tech, SSP. II-Sem  

Prerequisite: Advanced Digital Signal Processing

Course Objectives
The objectives of this course are to make the student
1. Understand the anatomy and Physiology of Speech Production system
2. To analyze the speech in time domain and extract various time domain parameters
3. To study various Speech Signal Processing applications viz: Speech Enhancement, Speech Recognition, Speaker Recognition.
4. To study various Audio coding techniques based on perceptual modeling of the human ear.

Course Outcomes
On completion of this course student will be able to
1. Model an electrical equivalent of Speech Production system.
2. Extract the LPC coefficients that can be used to Synthesize or compress the speech.
3. Design a Homomorphic Vocoder for coding and decoding of speech.
4. Understand the concepts of Speech and Speaker Recognition systems.
5. Design basic audio coding methods for audio signal.

UNIT – I

UNIT – II
Time Domain models for Speech Processing: Introduction – Window considerations, Short time energy, average magnitude, average zero crossing rate, Speech vs Silence discrimination using energy and zero crossing, pitch period estimation using a parallel processing approach, the short time autocorrelation function, average magnitude difference function, pitch period estimation using the autocorrelation function.

UNIT – III
Homomorphic Speech Processing
Speech Enhancement
UNIT – IV

**Automatic Speech Recognition**
Basic pattern recognition approaches, parametric representation of Speech, Evaluating the similarity of Speech patterns, Isolated digit Recognition System, Continuous word Recognition system. Elements of HMM, Training & Testing of Speech using HMM.

**Automatic Speaker Recognition**
Recognition techniques, Features that distinguish speakers, MFCC, delta MFCC, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System, Performance Metrics.

UNIT – V

**Audio Coding**

**TEXT BOOKS**

**REFERENCES**
COMMUNICATION TECHNOLOGIES
(PE-4)

M.Tech, SSP. II Sem

Pre-requisite: None

Course Objectives

1. To know about Second Generation and Third Generation Cellular technologies
2. To study the Evolution Generation(2.5G) technology platforms,
3. To learn about OFDM modulation technique and their evaluation parameters.
4. To understand UWB wireless channels, data modulation and its features.

Course Outcomes

Upon completing this course, the student will be able to
1. Compare various Generation technologies and their architectures.
3. Get the knowledge of OFDM and evaluate the performance using channel model and SNR, issues regarding OFDM.
4. Acquire the knowledge about UWB wireless channels, data modulation and their features.

UNIT I
Second Generation (2G)
Overview, Enhancements over 1G Systems, Integration with Existing 1G Systems, GSM, IS-136 System Description, IS-95 System Description, iDEN (Integrated Dispatch Enhanced Network), CDPD

UNIT II
Evolution Generation (2.5G)
Enhancements over 2G, Technology Platforms, General Packet Radio Service, (GPRS), Enhanced Data Rates for Global Evolution (EDGE), High-Speed Circuit Switched Data (HSCSD), CDMA2000 (1XRTT), WAP, Migration Path from 2G to 2.5G to 3G,

UNIT III
Third Generation (3G)

UNIT IV
OFDM

UNIT V
UWB
UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train.
TEXT BOOKS

REFERENCES
SPREAD SPECTRUM COMMUNICATIONS
(PE – 4)

M.Tech, SSP. II-Sem

Prerequisite: Digital Communications

Course Objectives
The objectives of this course are to make the student
1. Understand the concept of Spread Spectrum and study various types of Spread spectrum sequences and their generation.
2. Understand the principles of Code Division Multiple Access (CDMA) and use of Spread spectrum concept in CDMA
3. Understand various Code tracing loops for optimum tracking of wideband signals viz spread spectrum signals
4. Understand the procedure for synchronization of receiver for receiving the Spread spectrum signal.
5. Study the performance of spread spectrum systems in Jamming environment, systems with Forward Error Correction and Multiuser detection in CDMA cellular radio.

Course Outcomes
On completion of this course student will be able to
1. Generate various types of Spread spectrum sequences and can simulate CDMA system (Both Transmitter & Receiver).
2. Analyze the performance of Spread spectrum systems in Jamming environment and systems with Forward Error Correction.
3. Can provide detection and cancellation schemes for Multi-user’s in CDMA cellular radio.

UNIT -I
Introduction to Spread Spectrum Systems

Binary Shift Register Sequences for Spread Spectrum Systems
Introduction, Definitions, Mathematical Background and Sequence Generator Fundamentals, Maximal Length Sequences, Gold Codes.

UNIT -II
Code Tracking Loops
Introduction, Optimum Tracking of Wideband Signals, Base Band Delay-Lock Tracking Loop, Tau-Dither Non- Coherent Tracking Loop, Double Dither Non-Coherent Tracking Loop.

UNIT -III
Initial Synchronization of the Receiver Spreading Code
Introduction, Problem Definition and the Optimum Synchronizer, Serial Search Synchronization Techniques, Synchronization using a Matched Filter, Synchronization by Estimated the Received Spreading Code.
UNIT -IV
Cellular Code Division Multiple Access (CDMA) Principles
Introduction, Wide Band Mobile Channel, The Cellular CDMA System, Single User Receiver in a Multi User Channel, CDMA System Capacity,
Multi-User Detection in CDMA Cellular Radio

UNIT -V
Performance of Spread Spectrum Systems in Jamming Environments
Spread Spectrum
Performance of Spread Spectrum Systems with Forward Error Correction
Elementary Block Coding Concepts, Optimum Decoding Rule, Calculation of Error Probability, Elementary Convolution Coding Concepts, Viterbi Algorithm, Decoding and Bit-Error Rate.

TEXT BOOKS

REFERENCES
AD-HOC AND WIRELESS SENSOR NETWORKS
(PE- 4)

M.Tech, SSP. II-Sem

Prerequisite: Wireless Sensor Networks

Course Objectives

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

Course Outcomes

On completion of this course student will be able to
1. Students will be able to understand the basis of Ad-hoc wireless networks.
2. Students will be able to understand design, operation and the performance of MAC layer protocols of Adhoc wireless networks.
3. Students will be able to understand design, operation and the performance of routing protocol of Adhoc wireless network.
4. Students will be able to understand design, operation and the performance of transport layer protocol of Adhoc wireless networks.
5. Students will be able to understand sensor network Architecture and will be able to distinguish between protocols used in Adhoc wireless network and wireless sensor networks.

UNIT - I


UNIT - II

UNIT - III

UNIT – IV

UNIT – V
TEXT BOOKS


REFERENCES

MULTI-MEDIA AND SIGNAL CODING  
(PE-4)

M.Tech, SSP. II-Sem  

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Prerequisite: Artificial Neural Networks and Fuzzy Systems.

Course Objectives  
This course makes the students to Understand  
1. Various image & video processing algorithms.  
2. Various video compression techniques.  
3. Various audio compression techniques.

Course Outcomes  
On completion of this course the students will be able to  
1. Represent and convert various colour models.  
2. Simulate various video compression image techniques and can suggest the appropriate video compression techniques for specific application.  
3. Simulate various audio compression techniques and can suggest the appropriate audio compression method for specific application.

UNIT -I  
Introduction to Multimedia  

Color in Image and Video  

UNIT -II  
Video Concepts  
Types of Video Signals, Analog Video, Digital Video.

Audio Concepts  
Digitization of Sound, Quantization and Transmission of Audio.

UNIT -III  
Compression Algorithms  
Lossless Compression Algorithms  
Run Length Coding, Variable Length Coding, Arithmetic Coding, Lossless JPEG, Image Compression.

Lossy Image Compression Algorithms: Transform Coding: KLT And DCT Coding, Wavelet Based Coding.

UNIT -IV
Video Compression Techniques: Introduction to Video Compression, Video Compression Based on Motion Compensation, Search for Motion Vectors, H.261- Intra-Frame and Inter-Frame Coding, Quantization, Encoder and Decoder, Overview of MPEG1 and MPEG2.

UNIT -V

TEXT BOOKS

REFERENCES
COMMUNICATION AND NETWORKS LAB

M.Tech, SSP. II Sem

List of Programs

1. Simulation and analysis of MAC Layer protocols.
2. Simulation and analysis of various topologies.
3. Simulation and analysis of wired routing protocols.
4. Simulation and analysis of wireless routing protocols.
5. Simulation and analysis of various security attacks.
6. Analysis of log files and provides the intruder statistics.
7. Simulation of Queue Management Schemes.
8. Evaluation of DES, AES and Triple-DES.
10. Study of I2C and UART protocols.
11. Setting up of node to emulate RPL border router protocol
12. Collecting sensor values of remote nodes using RPL border router
SIMULATION LAB

M.Tech, SSP. II-Sem

Note:

Minimum of 10 Experiments have to be conducted

1. Plotting the Sensor data over a specific time interval
2. Simulate spatially separated target signal in the presence of Additive Correlated White Noise.
5. Design a two class classifier using SVM/ Bayes classifier
6. Evaluate the performance of Bayes/ MAP estimator.
7. Error correcting coding in CDMA Mobile communication system.
8. Capturing and tracking of GOLD sequence in CDMA system.
11. Estimation of data series using Nth order forward predictor and comparing to the original signal.
HIGH PERFORMANCE NETWORKS
(PE-5)

M.Tech, SSP. III-Sem

Prerequisite: Computer Networks

Course Objectives
At the end of the course, the students will be able to:
1. Understand the architecture and functioning of wireless LANs and Adhoc Networks.
2. Know the importance of QoS and techniques to improve QoS in wired and Adhoc Networks.
3. Understand the Mac and Network layer QoS solutions
4. Understand various QoS models and energy management techniques in adhoc wireless networks.
5. Understand the architecture, functioning and protocols of wireless sensor networks and the recent advances in wireless networks.

Course Outcomes
After completing this course the student must demonstrate the knowledge and ability to
1. Analyze Mac and Network layers of wireless LANs.
3. Analyze and compare Mac and Network layer QoS Solutions
5. Analyze and compare various data dissemination techniques of wireless sensor networks and also understand the functioning of ultra wide band radio communications and wireless fidelity systems.

UNIT I
Wireless LANs
Fundamentals of WLANs, Technical Issues, Differences Between Wireless and Wired Transmission, Use of WLANs, Design Goals, Network Architecture, Infrastructure Based Versus Ad Hoc LANs Components in a TypicalIEEE802.11 Network, Services Offered by a TypicalIEEE802.11 Network, IEEE802.11 standard, MAC Sub layer, Addressing Mechanism, Physical Layer

Ad Hoc Wireless Networks
Cellular and Ad hoc Wireless Networks, Application of Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks

UNIT II
Quality of Service(QoS) Techniques to Improve QoS Scheduling, Traffic Shaping, Resource Reservation, Admission Control, Integrated Services- Signaling, Flow Specification, Admission, Service Classes, RSVP, Problems with Integrated Services , Differentiated Services

Quality of Service in Ad Hoc Wireless Networks
UNIT III
MAC Layer and Network Layer QoS Solutions
MAC Layer Solutions
Cluster TDMA, IEEE802.11e, IEEE802.11, MAC Protocols- Distributed Coordination Function, Point Coordination Function, QoS Support Mechanisms of IEEE802.11e, Enhanced Distributed Coordination Function, Hybrid Coordination Function

Network Layer Solutions

UNIT IV
QoS Models
QoS frame work for Ad Hoc Wireless Networks. QoS Models, QoS Resource Reservation Signaling, INSIGNIA, INORA, SWAN Models.

Energy management in Ad hoc wireless networks
Need for Energy management in Adhoc wireless networks, classification of Energy management schemes, Battery management schemes Transmission power management schemes

UNIT V
Wireless Sensor Networks

Ultra-Wide-Band Radio Communication
Operation of UWB Systems, A Comparison of UWB with Other Technologies, Major Issues in UWB, Physical Layer, MAC Layer, Advantages and Disadvantages of UWB

Wireless Fidelity Systems, Systems, Issues, Security, Authentication, Quality of Service (QoS),Economics of Wi-Fi, Spectrum Issues, Interoperability of Wi-Fi Systems

TEXT BOOKS

REFERENCES
1. Ad Hoc and Sensor Networks Theory and Appications- Carols de Morais Cordeiro and Dharma prakash Agrawal, World Scientific
SOFTWARE DEFINED RADIO  
(PE-5)

M.Tech, SSP. III-Sem

Prerequisite: TCP/IP, Digital Signal Processing

Course Objectives
The objectives of this course is
1. To provide fundamentals and state of the art concepts in software defined radio.

Course Outcomes
On completion of this course, the students:
1. Understand the design principles of software defined radio.
2. Understand the analog RF components as front end block in implementation of SDR.
3. Understand digital hardware architectures and development methods.
4. Understand the radio recourse management in heterogeneous networks.
5. Understand the object oriented representation of radio and network resources.

UNIT –I
Introduction
The Need for Software Radios, What is Software Radio, Characteristics and benefits of software radio- Design Principles of Software Radio, RF Implementation issues- The Purpose of RF Front – End, Dynamic Range- The Principal Challenge of Receiver Design – RF Receiver Front- End Topologies- Enhanced Flexibility of the RF Chain with Software Radios- Importance of the Components to Overall Performance- Transmitter Architectures and Their Issues- Noise and Distortion in the RF Chain, ADC and DAC Distortion.

UNIT –II
Profile and Radio Resource Management
Communication Profiles- Introduction, Communication Profiles, Terminal Profile, Service Profile, Network Profile, User Profile, Communication Profile Architecture, Profile Data Structure, XML Structure, Distribution of Profile Data, Access to Profile Data, Management of Communication Profiles, Communication Classmarks, Dynamic Classmarks for Reconfigurable Terminals, Compression and Coding, Meta Profile Data

UNIT –III
Radio Resource Management in Heterogeneous Networks

UNIT –IV
Reconfiguration of the Network Elements
Introduction, Reconfiguration of Base Stations and Mobile Terminals, Abstract Modelling of Reconfigurable Devices, the Role of Local Intelligence in Reconfiguration, Performance Issues, Classification and Rating of Reconfigurable Hardware, Processing Elements, Connection Elements, Global Interconnect Networks, Hierarchical Interconnect Networks, Installing a New Configuration, Applying Reconfiguration Strategies, Reconfiguration Based on Comparison, Resource Recycling, Flexible Workload Management at the Physical Layer, Optimized Reconfiguration, Optimization
Parameters and Algorithms, Optimization Algorithms, Specific Reconfiguration Requirements, Reconfiguring Base Stations, Reconfiguring Mobile Terminals

UNIT –V
Object – Oriented Representation of Radios and Network Resources
Networks- Object Oriented Programming- Object Brokers- Mobile Application Environments- Joint Tactical Radio System.

Case Studies in Software Radio Design
Introduction and Historical Perspective, SPEAK easy- JTRS, Wireless Information Transfer System, SDR-3000 Digital Transceiver Subsystem, Spectrum Ware, CHARIOT.

TEXT BOOKS

REFERENCES
SOFT COMPUTING TECHNIQUES  
(PE - 5)

M.Tech, SSP. III-Sem

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Pre-requisite: NIL

Course Objectives
1. To learn design concepts of neural networks.
2. Know the associative memory and ART architectures.
3. Familiarize with utility of fuzzy logic and genetic algorithm.

Course Outcomes
Upon completing this course, the student will be able to
1. Design feed forward and backward neural network architectures.
2. Understand the architectures of associate memory and ART architectures.
4. Learn about various types of hybrid systems.

UNIT – I
Fundamentals of Neural Networks & Feed Forward Networks
Basic Concept of Neural Networks, Human Brain, Models of an Artificial Neuron, Learning Methods, Neural Networks Architectures, Single Layer Feed Forward Neural Network :The Perceptron Model, Multilayer Feed Forward Neural Network :Architecture of a Back Propagation Network (BPN), The Solution, Backpropagation Learning, Selection of various Parameters in BPN. Application of Back propagation Networks in Pattern Recognition & Image Processing.

UNIT – II
Associative Memories & ART Neural Networks
Basic concepts of Linear Associative, Basic concepts of Dynamical systems, Mathematical Foundation of Discrete-Time Hop field Networks (HPF), Mathematical Foundation of Gradient-Type Hopfield Networks, Transient response of Continuous Time Networks, Applications of HPF in Solution of Optimization Problem: Minimization of the Traveling salesman tour length, Summing networks with digital outputs, Solving Simultaneous Linear Equations, Bidirectional Associative Memory Networks; Cluster Structure, Vector Quantization, Classical ART Networks, Simplified ART Architecture.

UNIT – III
Fuzzy Logic & Systems
Fuzzy sets, Crisp Relations, Fuzzy Relations, Crisp Logic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based system, Defuzzification Methods, Applications: Greg Viot’s Fuzzy Cruise Controller, Air Conditioner Controller.

UNIT – IV
Genetic Algorithms
UNIT – V
Hybrid Systems

TEXT BOOKS
1. Introduction to Artificial Neural Systems - J.M.Zurada, Jaico Publishers

REFERENCES
1. Artificial Neural Networks - Dr. B. Yagananarayana, , PHI, 1999.
RF CIRCUIT DESIGN

M.Tech, SSP. III Sem

Pre-requisite: NIL

Course Objectives
1. Learn the concepts of RF frequency analysis and component modelling.
2. To give understanding of various types of RF filter circuits.
3. To familiarize the Concept of RF amplifiers and oscillators.

Course Outcomes
Upon completing this course, the student will be able to

1. Understand High Frequency Analysis.
2. Understand the concepts of component modelling and biasing networks.
3. Design the various RF filters, amplifiers, oscillators and mixers.

UNIT I
Introduction
Importance of RF design dimensions and units frequency spectrum RF behavior of passive components: high frequency resistors, high frequency capacitors, high frequency inductor. chip components and circuit board Considerations chip resistors chip capacitors and surface mount inductors.

UNIT II
RF filter design
Scattering parameters: definition, meaning chain, scattering matrix, conversion between S- and Z-parameters, signal flow chart modeling, generalization basic resonator and filter configurations: low pass, high pass, band pass and band stop type filters-filter implementation using unit element and kuroda's identities transformations-coupled filters

UNIT III
Active RF component modeling
 RF diode models: nonlinear and linear models transistor models: large signal and small signal BJT models, large signal and small signal FET models-scattering parameters device characterization.

Matching and biasing networks

UNIT IV
RF transistor amplifier design
Characteristics of amplifier-amplifier power relations RF sources, transducers power gain, additional power relations-stability consideration: stability circles, unconditional stability and stabilization methods-unilateral and bilateral design for constant gain noise figure circles- constant VSWR circles.
UNIT V

RF oscillators and mixers
Basic oscillator models: Negative resistance oscillator, feedback oscillator design, design steps, quads oscillators- fixed frequency, high frequency oscillator- basic characteristics of mixers: concepts, frequency domain considerations, single ended mixer design, single and double balanced mixers.

TEXTBOOKS
1. RF circuit design- theory and applications - Reinhold Ludwig Pavel bsetchko- pearson education India 2000
2. Radio frequency and microwave communication circuits- analysis and design- devendra k Mishra- wiley student edition- john wiley and sons inc

REFERENCES
1. Radiofrequency and microwave electronics mathew m rarmaneah PEI
2. RF circuit design christoper BOWIK Cheryl aijuni and john butler elsevier science 2008
3. Secrets of RF circuit design joseph jcarr tmh 2000
4. Design of RF and microwave amplifiers and oscillators peter ID
PRINCIPLES OF SIGNAL PROCESSING  
(OE- I)

M.Tech, SSP. III Sem                                      L  T  P  C  
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Pre-requisite: NIL

Course Objectives
1. This gives the basics of Signals and Systems required for all Engineering related courses.
2. To understand the basic characteristics of LTI systems
3. To know the signal transmission requirements.
4. This gives basic understanding of signal statistical properties and noise source concepts.

Course Outcomes
Upon completing this course, the student will be able to

1. Differentiate various signal functions.
2. Understand the characteristics of linear time invariant systems.
3. Understand the concepts sampling theorem.
4. Determine the Spectral and temporal characteristics of Signals.
5. Understand the concepts of Noise in Communication systems.

UNIT I
Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

UNIT II
Signal Transmission through Linear Systems
Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

UNIT III
Sampling theorem: Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

UNIT IV

UNIT V
Noise sources: Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties.
TEXT BOOKS

REFERENCES
2. Random Processes for Engineers-Bruce Hajck, Cambridge unipress, 2015