ACADEMIC REGULATIONS
COURSE STRUCTURE AND
DETAILED SYLLABUS

ELECTRONICS & COMMUNICATION ENGINEERING

For

M. Tech. (Systems & Signal Processing)
(Two Year Full Time Programme)

JNTUH COLLEGE OF ENGINEERING HYDERABAD
(Autonomous)
Kukatpally, Hyderabad – 500 085, Telangana, India.

2015
JNTUH COLLEGE OF ENGINEERING HYDERABAD  
M.Tech. (Systems & Signal Processing) – Full Time w.e.f. 2015-16

I – SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Random Processes and Queuing Theory</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Advanced Digital Signal Processing</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Elective-I</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Elective-II</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Elective-III</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Elective-IV</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Signal Processing Laboratory</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Seminar</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II – SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wireless Communications and Networks</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Adaptive Signal Processing</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Elective-V</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Elective-VI</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Elective-VII</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Elective-VIII</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Advanced Communications and Networking Laboratory</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Soft Skills Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td>28</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

III – SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Comprehensive Viva Voce</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Project Phase -I</td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
</tbody>
</table>

IV – SEMESTER

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Project Phase-II &amp; Dissertation</td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td></td>
<td><strong>Total credits</strong></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>
Elective – I
1. Transform Techniques
2. Digital System Design with PLDs
3. Advanced Data Communications

Elective – II
1. Speech and Audio Signal Processing
2. VLSI Technology and Design

Elective – III
1. Biomedical Signal Processing
2. CMOS Analog Integrated Circuit Design
3. Detection and Estimation Theory

Elective – IV
2. TCP/IP and ATM Networks.
3. Optimization Techniques.

Elective – V
1. Digital Signal Processors and Controllers
2. Mobile Computing

Elective – VI
1. Image and Video processing
2. 4G Technologies
3. VLSI Signal Processing

Elective – VII
1. Software Defined Radio
2. Network Security and Cryptography
3. Radar Signal Processing

Elective – VIII
1. Multi-Media and Signal Coding
2. Soft Computing Techniques
3. Advanced Computer Networks
Prerequisite: Probability Theory & Stochastic Processes

Course Objectives:
1. To expose the students to the random process and queuing theory related topics for their subsequent study of Computer Networks and wireless communication and Networks.

Course Outcomes:
Students will be able to:
1. Understand Random variables as an intrinsic need for the analysis of random phenomena.
2. Evaluate and apply moments and Characteristics functions.
3. Understand the concept of random process spectral density of stationary process.
4. Understand the concepts of Markov Chains and queuing theory.
5. Understand the concepts of $M|M|1$, $M|M|1|K$, $M|G|1$ queuing Process.
6. Understand the modeling of telecommunication networks using appropriate 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 $M/M/\infty$ 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
Introduction, Contention based protocols- Aloha, Slotted Aloha, Aloha Protocol with ideal
capture effect, CSMA Schemes, Demand assignment protocols-Polling protocol, Token
passing protocol, Analysis of token and polling Schemes, R-Aloha, PRMA protocol,
Comparisons between CSMA/CD and Token Protocols, Fixed assignment Protocols- FDMA,
TDMA, Resource reuse in cellular systems, CDMA.

TEXTBOOK
1. Queuing Theory and Telecommunications Networks and Applications, Springer,
   Giovanni Giambene.

REFERENCE BOOKS:
1. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis, S.
   Unnikrishna Pillai – TMH, 2008
2. Probability and Random Processes with Applications to Signal Processing – Henry
3. Probability and Stochastic Processes – A Friendly Introduction for Electrical and
ADVANCED DIGITAL SIGNAL PROCESSING

Prerequisite: Digital Signal Processing

Course Objectives:
The objectives of this course are to make the student
1. Understand the design of various types of digital filters and implement them using various implementation structures and study the advantages & disadvantages of a variety of design procedures and implementation structures.
2. Understand the concept and need for Multirate signal Processing and their applications in various fields of Communication & Signal Processing
4. Study various Parametric & Non parametric methods of Power spectrum estimation techniques and their advantages & disadvantages
5. Understand the effects of finite word/registro length used in hardware in implementation of various filters and transforms using finite precision processors.

Course Outcomes:
On completion of this course student will be able to
1. Design and implement a filter which is optimum for the given specifications.
2. Design a Multirate system for the needed sampling rate and can implement the same using Polyphase filter structures of the needed order.
3. Estimate the power spectrum of signal corrupted by noise through a choice of estimation methods: Parametric or Non Parametric.
4. Can calculate the output Noise power of different filters due to various finite word length effects viz: ADC Quantization, product quantization, and can calculate the scaling factors needed to avoid Limit cycles: Zero input, overflow. Also they can decide the stability of the system by studying the effect due to coefficient quantization while implementing different filters and transforms.

UNIT –I:
Review of DFT, FFT, IIR Filters and FIR Filters.

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:
Parametric Methods:
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:
Applications of Multi Rate Signal Processing

TEXT BOOKS:
2. Discrete Time signal processing - Alan V Oppenheim & Ronald W Schaffer, PHI.

REFERENCE BOOKS:
TRANSFORM TECHNIQUES  
(Elective – 1)  

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:  
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:  
Continuous Wavelet Transform (CWT)  
Short comings of STFT, Need for wavelets, Wavelet Basis- Concept of Scale and its relation with frequency, Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT. Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

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:  

REFERENCE BOOKS:
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)  

DIGITAL SYSTEM DESIGN WITH PLDs  
(Elective – I)

Prerequisite: Switching Theory and Logic Design

Course Objectives:
1) To provide extended knowledge of digital logic circuits in the form of state model approach.
2) To provide an overview of system design approach using programmable logic devices.
3) To provide and understand of fault models and test methods.
4) To get exposed to the various architectural features of CPLDS and FPGAS.
5) To learn the methods and techniques of CPLD & FPGA design with EDA tools.
6) To expose software tools used for design process with the help of case studies.

Course Outcomes:
1) To understands the minimization of Finite state machine.
2) To exposes the design approaches using ROM’s, PAL’s and PLA’s.
3) To provide in depth understanding of Fault models.
4) To understands test pattern generation techniques for fault detection.
5) To design fault diagnosis in sequential circuits.
6) To provide exposure to various CPLDS and FPGAS available in market.
7) To acquire knowledge in one hot state machine design applicable to FPGA.
8) To get exposure to EDA tools.
9) To provide understanding in the design of flow using case studies.

UNIT-I:
Programmable Logic Devices:
The concept of programmable Logic Devices, SPLDs, PAL devices, PLA devices, GAL devices, CPLD-Architecture, Xilinx CPLDs- Altera CPLDs, FPGAs-FPGA technology, architecture, virtex CLB and slice- Stratix LAB and ALM-RAM Blocks, DSP Blocks, Clock Management, I/O standards, Additional features. [TEXTBOOK-1]

UNIT-II:
Analysis and derivation of clocked sequential circuits with state graphs and tables:
A sequential parity checker, Analysis by signal tracing and timing charts-state tables and graphs-general models for sequential circuits, Design of a sequence detector, More Complex design problems, Guidelines for construction of state graphs, serial data conversion, Alphanumeric state graph notation. [TEXTBOOK-2]

UNIT-III:
Sequential circuit Design:
Design procedure for sequential circuits-design example, Code converter, Design of Iterative circuits, Design of a comparator, Design of sequential circuits using ROMs and PLAs, Sequential circuit design using CPLDs, Sequential circuit design using FPGAs, Simulation and testing of Sequential circuits, Overview of computer Aided Design. [TEXTBOOK-2]
UNIT-IV:
Fault Modeling and Test Pattern Generation:
Logic Fault Model, Fault detection & redundancy, Fault equivalence and fault location, Fault dominance, Single stuck at fault model, multiple Stuck at Fault models, Bridging Fault model. Fault diagnosis of combinational circuits by conventional methods, path sensitization techniques, Boolean difference method, KOHAVI algorithm, Test algorithms-D algorithm, Random testing, transition count testing, signature analysis and test bridging faults. [TEXTBOOK-3 & Ref.1]

UNIT-V:
Fault Diagnosis in sequential circuits:
Circuit Test Approach, Transition check Approach, State identification and fault detection experiment, Machine identification, Design of fault detection experiment. [Ref.1]

TEXTBOOKS:
1. Digital Electronics and design with VHDL- Volnei A. Pedroni, Elsevier publications.
3. Logic Design Theory-N.N.Biswas,PHI

REFERENCES:
2. Digital System Design using programmable logic devices- Parag K.Lala, BS publications.
ADVANCED DATA COMMUNICATIONS
(Elective – I)

**Prerequisite:** Digital Communication

**Course Objectives:**
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 protocol and point to point protocols.
4. To understand Medium Access Control sub layer protocols
5. To know about Switching circuits, Multiplexing and Spectrum Spreading techniques for data transmission.
6. To study Wired LANs different Ethernet standards

**Course Outcomes:**
At the end of the course, the student will be able to:
1. Understand the concepts of Data Communication networks, different protocols, standards and layering.
2. Acquire the knowledge of error detection, forward and reverse error correction techniques.
3. Analyze link layer protocol and point to point protocols
4. Explain and compare the performance of different MAC protocols like Aloha, CSMA, CSMA/CA, TDMA, FDMA & CDMA.
5. Understand the features and the significance of Switching circuits, Multiplexing and Spectrum Spreading for data transmission.
6. Understand the characteristics of Wired LANs and also the operation and applications of Connecting Devices
7. Understand the services and functions of Network layer protocols.

**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 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).

Unit IV
Switching: Introduction to Switching, Circuit Switched Networks, Packet Switching, Structure of switch
Multiplexing and Spectrum Spreading: Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing, Spread Spectrum -Frequency Hopping Spread Spectrum and Direct Sequence Spread Spectrum.

Unit V
Wired LANS: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet
Connecting Devices: Hubs, Link Layer Switches, Routers
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.

TEXT BOOKS:
1. Data Communications and Networking - B. A. Forouzan, 5th, 2013, TMH.

REFERENCE BOOKS:
1. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
2. Data Communications and Networking - B. A. Forouzan, 2nd, 2013, TMH.
SPEECH AND AUDIO SIGNAL PROCESSING (Elective-II)

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 and perception model and to design an electrical equivalent of Acoustic model for Speech Production.
2. To understand the articulatory and acoustic interpretation of various phonemes and their allophones.
3. To analyze the speech in time domain and extract various time domain parameters which can be used for various applications like pitch extraction, end point detection, Speech Compression, Speech Synthesis etc.,
4. To study the concept of Homomorphic system and its use in extracting the vocal tract information from speech using Cepstrum which is a by product of Homomorphic processing of Speech.
5. To study various Speech Signal Processing applications viz: Speech Enhancement, Speech Recognition, Speaker Recognition.
6. 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. Enhance the speech and can design an Isolated word recognition system using HMM.
5. Can extract the features for Automatic speaker recognition system which can used for classification.
6. Can design basic audio coding methods for coding the audio signal.

Unit – I:
Fundamentals of Digital Speech Processing:


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.
Linear Predictive Coding (LPC) Analysis:

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:

REFERENCE BOOKS:
Prerequisite: ICA / VLSI

Course Objectives:
1) Students from other engineering background to get familiarize with large scale integration technology.
2) To expose fabrication methods, layout and design rules.
3) Learn methods to improve Digital VLSI system's performance.
4) To know about VLSI Design constraints.
5) Visualize CMOS Digital Chip Design.

Course Outcomes:
1) Review of FET fundamentals for VLSI design.
2) To acquires knowledge about stick diagrams and layouts.
3) Enable to design the subsystems based on VLSI concepts.

UNIT –I: Review of Microelectronics and Introduction to MOS Technologies:
MOS, CMOS, BiCMOS Technology. Basic Electrical Properties of MOS, CMOS & BiCMOS Circuits: Ids – Vds relationships, Threshold Voltage VT, Gm, Gds and ωo, Pass Transistor, MOS, CMOS & Bi CMOS Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits.

UNIT –II: Layout Design and Tools:
Transistor structures, Wires and Vias, Scalable Design rules, Layout Design tools.
Logic Gates & Layouts:
Static Complementary Gates, Switch Logic, Alternative Gate circuits, Low power gates, Resistive and Inductive interconnect delays.

UNIT –III: Combinational Logic Networks:
Layouts, Simulation, Network delay, Interconnect design, Power optimization, Switch logic networks, Gate and Network testing.

UNIT –IV: Sequential Systems:
Memory cells and Arrays, Clocking disciplines, Design, Power optimization, Design validation and testing.

UNIT –V: Floor Planning:
Floor planning methods, Global Interconnect, Floor Plan Design, Off-chip connections.

TEXT BOOKS:

REFERENCE BOOKS:
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)  |  L T P C
                                                      |  4 0 0 4

SPREAD SPECTRUM COMMUNICATIONS
(Selective – II)

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 Multiusers in CDMA cellular radio.

UNIT -I:

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

UNIT -II:

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

**UNIT V:**

**TEXT BOOKS:**

**REFERENCE BOOKS:**
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)                                                 L   T    P    C   
                                                                                         4    0     0   4

BIOMEDICAL SIGNAL PROCESSING  
(Elective – III) 

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 derive the noise power Spectral Density of Random signals and its analysis.  
3. To understand lossless and lossy compression techniques related to ECG data.  
4. To understand various cardiological signal processing techniques and noise cancellation techniques.  
5. To understand estimation of signals using Prony's and least square and linear prediction methods.  
6. To analyze evoked potentials.  
7. 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. Analyze random signals using power spectral densities.  
3. Compare various lossless and lossy techniques.  
4. Compare various ECG processing and noise cancellation techniques.  
5. Analyze evoked potentials.  
6. Model and estimate EEG signals and various sleep stages. 

UNIT -I:  
Random Processes  
Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth and noise figure of systems.  

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:  

19
UNIT-V:

**Neurological Signal Processing:** Modelling of EEG Signals, Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modelling of seizure EEG. Sleep Stage analysis, Inverse Filtering, Least squares and polynomial modelling.

**TEXT BOOKS:**

**REFERENCE BOOKS:**
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)  L  T  P  C
4  0  0  4

CMOS ANALOG INTEGRATED CIRCUIT DESIGN
(Elective – III)

Prerequisite: Analog Electronics

Course Objectives:
Analog circuits play a very crucial role in all electronic systems and due to continued miniaturization, many of the analog blocks are not getting realized in CMOS technology.

1. To understand most important building blocks of all CMOS analog ICs
2. To study the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design common to all analog CMOS ICs.
3. To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
4. To understand the design of differential amplifiers, current amplifiers and OP AMPs.

Course Outcomes:
After studying the course, each student is expected to be able to:
1. Design basic building blocks of CMOS analog ICs.
2. Carry out the design of single and two stage operational amplifiers and voltage references.
3. Determine the device dimensions of each MOSFETs involved.
4. Design various amplifiers like differential, current and operational amplifiers.

UNIT -I:
MOS Devices and Modeling:

UNIT -II:
Analog CMOS Sub-Circuits:
MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT -III:
CMOS Amplifiers:
Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT -IV:
CMOS Operational Amplifiers:
UNIT -V:
Comparators:
Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

TEXT BOOKS:

REFERENCE BOOKS:
3. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce, PHI.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)                         L    T    P    C
                                                        4    0    0    4

DETECTION AND ESTIMATION THEORY
(EventArgs-Ill)

Prerequisite: Probability Theory and Stochastic Processes

Course Objectives:
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.
3. Students learn the statistics and estimating the parameters of Random Process from
detection.

Course Outcomes:
1. Students will understand the basic detection methods.
2. Learn about basic estimation methods.
3. Gain ability to apply estimation method for real time engineering problems.

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

UNIT –V:
Estimating the Parameters of Random Processes from Data: Tests for Stationarity and
Ergodicity, Model-free Estimation, Model-based Estimation of Autocorrelation Functions,
Power Special Density Functions.

TEXT BOOKS:
1. Random Signals: Detection, Estimation and Data Analysis – K. Sam Shanmugan & A.M.
   Breipohl, Wiley India Pvt. Ltd, 2011.
   India Pvt. Ltd., 2010.
REFERENCE BOOKS:
3. Introduction to Statistical Signal Processing with Applications – Srinath, Rajasekaran, Viswanathan, 2003, PHI.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)  
CODING THEORY AND TECHNIQUES  
(Elective - IV)

L T P C 4 0 0 4

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:
1. Learning the measurement of information and errors.
2. Obtain knowledge in designing various codes like block codes, cyclic codes, convolution codes, turbo codes and space codes.

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:

REFERENCE BOOKS:
2. Digital Communications-Fundamental and Application - Bernard Sklar, PE.
4. Introduction to Error Control Codes-Salvatore Gravano-oxford
TCP/IP AND ATM NETWORKS  
(Elective - IV)

Prerequisite: Computer Networks

Course Objectives:
1. To study Network Layer Protocols, Next Generation IP protocols
3. To understand techniques to improve QoS
4. To learn about the features of ATM networks.
5. To study the 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 features of Virtual circuit networks like ATM networks and their applications
5. Design and analyze various types of Interconnection Networks, understand the functioning of Folding, Benes, Lopping bit allocation algorithms and their significance.

Unit I
Network Layer Protocols: Internet Protocol (IP), ICMPv4, Mobile IP

Unit II
User Datagram Protocol: User Datagram, UDP Services, UDP Applications
Transmission Control Protocol: TCP Services, TCP Features, Segments, TCP Connection, State Transition Diagram, Windows in TCP, Flow and Error Control, TCP Congestion Control, TCP Timers,

Unit III
Congestion Control and Quality of Service: Data Traffic, Congestion, Congestion Control, Quality of Service, Techniques to Improve QoS, Integrated Services, Differentiated Services, QoS in Switched Networks
Queue Management: Passive-Drop trial, Drop front, Random drop, Active- early Random drop, Random Early detection.
Unit IV
SONET/SDH: Architecture, SONET Layers, SONET Frames, STS Multiplexing, SONET Networks

Unit V
Interconnection Networks
Introduction, Banyan Networks, Properties, Crossbar switch, Three stage Class networks, Rearrangeble Networks, Folding algorithm, Benes Networks, Lopping algorithm, Bit allocation algorithm.

TEXT BOOKS:
2. High Performance TCP/IP Networking –Mahabub Hassan and Raj Jain ,PHI,2005

REFERENCE BOOKS:
2. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)  L T P C

OPTIMIZATION TECHNIQUES
(Elective – IV)

Prerequisite: None

Course Objectives:
1. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
2. To develop an interest in applying optimization techniques in problems of Engineering and Technology
3. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

Course Outcomes:
Upon the completion of this course, the student will be able to
1. Know basic theoretical principles in optimization
2. formulate optimization models and obtain solutions for optimization;
3. apply methods of sensitivity analysis and analyze post processing of results

UNIT – I: INTRODUCTION AND CLASSICAL OPTIMIZATION TECHNIQUES:

CLASSICAL OPTIMIZATION TECHNIQUES:

UNIT – II: LINEAR PROGRAMMING:

UNIT – III: TRANSPORTATION PROBLEM:
Finding initial basic feasible solution by north – west corner rule- least cost method and Vogel’s approximation method – testing for optimality of balanced transportation problems.

UNIT – IV: UNCONSTRAINED OPTIMIZATION TECHNIQUES:
Univariate method-Powell’s method and steepest descent method.

CONSTRAINED NONLINEAR PROGRAMMING:
UNCONSTRAINED NONLINEAR PROGRAMMING:
One – dimensional minimization methods: Classification-Fibonacci method and Quadratic interpolation method

UNIT – V: DYNAMIC PROGRAMMING:

TEXT BOOKS:

REFERENCE BOOKS:
2. Dr. S.D.Sharma,”Operations Research”
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year I-Sem (Systems & Signal Processing)  

SIGNAL PROCESSING LABORATORY

**Note:**

A. Minimum of 10 Experiments have to be conducted  
B. All Experiments may be Simulated using MATLAB and to be verified theoretically.

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)
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing)         L   T   P   C
                                                                        4   0   0   4

WIRELESS COMMUNICATIONS AND NETWORKS

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 prepare students to understand the concept of frequency reuse, and be able to apply it in the design of mobile cellular system.
4. To prepare students to understand various modulation schemes and multiple access techniques that are used in wireless communications,
5. 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.
6. To train students to understand the architecture and operation of various wireless wide area networks such as GSM, IS-95, GPRS and SMS.
7. To train students to understand wireless LAN architectures and operation.
8. To prepare students to understand the emerging technique OFDM and its importance in the wireless communications.

Course Outcomes:
Upon completion of the course, the student will be able to:
1. Understand the principles of wireless communications.
2. Understand fundamentals of wireless networking
3. Understand cellular system design concepts.
4. Analyze various multiple access schemes used in wireless communication.
5. Understand wireless wide area networks and their performance analysis.
6. Demonstrate wireless local area networks and their specifications.
7. Familiar with some of the existing and emerging wireless standards.
8. 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
Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models-Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

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, Comparision of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

TEXT BOOKS:

REFERENCE BOOKS:
1. Wireless Digital Communications – Kamilo Feher, 1999, PHI.
ADAPTIVE SIGNAL PROCESSING

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. Design, implement and apply Wiener Filters (FIR, non-casual, causal) and evaluate their performance.
3. To understand innovation process, Kalman filter theory and estimation of state using the Innovation Process, concept of Kalman Gain and Filtering.
4. Design, implement and apply LMS, RLS and Kalman filters to given applications.

UNIT –I:

UNIT –II:

UNIT –III:

UNIT –IV:
and delay estimation. Adaptive Beam forming, concept of IQ channels, Adaptive filter
implementation of Hilbert Transform. Introduction to MUSIC

UNIT –V:
State Estimators: Introduction to RLS Algorithm, Statement of Kalman filtering problem,
The Innovation Process, Estimation of State using the Innovation Process- Expression of
Kalman Gain, Filtering Example estimation of state from observations of noisy observed
narrow band signals. Target tracking using only DOA.

TEXT BOOKS:

REFERENCE BOOKS:
McGraw-Hill, Newyork
Springer –Verlag.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing)  

DIGITAL SIGNAL PROCESSORS AND CONTROLLERS  
( Elective – V )

Prerequisite: Microprocessors and Microcontrollers

Course Objectives:
1. To provide a comprehensive understanding of various programs of DSP Processors.  
2. To distinguish between the architectural difference of ARM and DSPs along with floating point capabilities.

Course Outcomes:
The students are  
1. Expected to learn various DSPs and their architectural features.  
2. Explore the ARM development towards the functional capabilities of DS Processing.  
3. Expected to work with ASM level program using the instruction set.  
4. To explore the selection criteria of DSP / ARM processors by understanding the functional level trade off issues.

UNIT-I: Introduction to Digital Signal Processing:  
Introduction, A digital Signal – Processing system, the sampling process, Discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time-invariant systems, Digital filters, Decimation and interpolation.  
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. [TEXTBOOK-1]

UNIT-II: Programmable Digital Signal Processors:  
Commercial Digital signal-processing Devices, 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. [TEXTBOOK-1]

UNIT-III: Architecture of ARM Processors:  
Introduction to the architecture, Programmer’s model- operation modes and states, registers, special registers, floating point registers, Behaviour of the application program status register(APSR)-Integer status flags, Q status flag, GE bits, Memory system-Memory system features, memory map, stack memory, memory protection unit (MPU), Exceptions and Interrupts-what are exceptions?, nested vectored interrupt controller(NVIC), vector table, Fault handling, System control block (SCB), Debug, Reset and reset sequence.  
Technical Details of ARM Processors:  
General information about Cortex-M3 and cortex M4 processors-Processor type, processor architecture, instruction set, block diagram, memory system, interrupt and exception support, Features of the cortex-M3 and Cortex-M4 Processors-Performance, code density, low power, memory system, memory protection unit, interrupt handling, OS support and system level features, Cortex-M4 specific features, Ease of use, Debug support, Scalability, Compatibility. [TEXTBOOK-2]
UNIT-IV:
Instruction SET: Background to the instruction set in ARM Cortex-M Processors, Comparison of the instruction set in ARM Cortex-M Processors, understanding the assembly language syntax, Use of a suffix in instructions, Unified assembly Language (UAL), Instruction set, Cortex-M4-specific instructions, Barrel shifter, Accessing special instructions and special registers in Programming. [TEXTBOOK-2]

UNIT-V: Floating Point Operations: About Floating Point Data, Cortex-M4 Floating Point Unit (FPU) overview, FP registers overview, CPACR register, Floating point register bank, FPSCR, FPU->FPCCR, FPU->FPCAR, FPU->FPDSCR, FPU->MVFR0, FPU->MVFR1.
ARM Cortex-M4 and DSP Applications:
DSP on a microcontroller, Dot Product example, writing optimised DSP code for the Cortex-M4-Biquad filter, Fast Fourier transform, FIR filter. [TEXTBOOK-2]

TEXTBOOKS:

REFERENCES:
MOBILE COMPUTING
( Elective – V )

Prerequisites:
1. Computer Networks
2. Distributed Systems OR Distributed Operating Systems OR Advanced Operating Systems

Course Objectives:
1. To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
2. To understand the typical mobile networking infrastructure through a popular GSM protocol.
3. To understand the issues and solutions of various layers of mobile networks, namely MAC layer, Network Layer & Transport Layer.
4. To understand the database issues in mobile environments & data delivery models.
5. To understand the ad hoc networks and related concepts.
6. To understand the platforms and protocols used in mobile environment.

Course Outcomes:
1. Able to think and develop new mobile application.
2. Able to take any new technical issue related to this new paradigm and come up with a solution(s).
3. Able to develop new ad hoc network applications and/or algorithms/protocols.
4. Able to understand & develop any existing or new protocol related to mobile environment.

UNIT – I:

UNIT – II:

UNIT – III:
Intelligent Networks and Interworking: Introduction – Fundamentals of Call processing – Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) – soft switch – Programmable Networks – Technologies and Interfaces for IN

UNIT –IV:

UNIT –V:

TEXT BOOKS:

REFERENCE BOOKS:
AD-HOC AND WIRELESS SENSOR NETWORKS
(Elective - V)

Prerequisite: Wireless Sensor Networks

Course Objectives:
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:
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:
Wireless LANs and PANs
AD HOC WIRELESS NETWORKS
Introduction, Issues in Ad Hoc Wireless Networks.

UNIT - II:
MAC Protocols

UNIT - III:
Routing Protocols

UNIT – IV:
Transport Layer Protocols
Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of
Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT – V:
Wireless Sensor Networks

TEXT BOOKS:

REFERENCE BOOKS:
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing)  L  T  P  C
4    0    0   4

IMAGE AND VIDEO PROCESSING
(Conic Elective – VI)

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.
4. Understand the representation of video.
5. Understand the principles and methods of motion estimation.

Course Outcomes:
1. The students will learn image representation, filtering, compression.
2. Students will learn the basics of video processing, representation, motion estimation.

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:**
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing)  

4G TECHNOLOGIES  
(Elective-VI)

Prerequisite: 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.
5. To study the 4G technology.

Course Outcomes:
At the end of the course, the student will be able to:
1. Explain and compare Second and Third Generation technologies and their architectures.
2. Understand improved version of 2G technology i.e., evolution Generation (2.5G) and data transmission using GPRS, EDGE, HSCSD.
3. Get the knowledge of Orthogonal Frequency Division Multiplexing 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:
2G and 3G technology
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:
The Evolution Generation (2.5G)
What Is 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:

UNIT IV:
UWB: UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train.
UNIT V:
**4G Cellular technology:**

**Text books:**
1. 3G Wireless Networks, 2nd ed., Clint Smith, P.E, Daniel Collins

**Reference Books:**
1. 3G Networks Architecture, Protocols and Procedures, Sumith Kaseara, Nishit Narang
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing)  

VLSI SIGNAL PROCESSING  
(Elective - VI)  

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 have obtained an appreciation of:
1. Ability to modify the existing or new DSP architectures suitable for VLSI.
2. Ability to implement fast convolution algorithms.
3. 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  

UNIT –II:
Folding and Unfolding  
Folding: Introduction - Folding Transform - Register minimization Techniques – Register minimization in folded architectures – folding of multirate systems  

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

TEXT BOOKS:

REFERENCE BOOKS:
SOFTWARE DEFINED RADIO (Elective-VII)

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 -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 -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, Optimised Reconfiguration, Optimisation Parameters and Algorithms, Optimization Algorithms, Specific Reconfiguration Requirements, Reconfiguring Base Stations, Reconfiguring Mobile Terminals


TEXT BOOKS:

REFERENCE BOOKS:
NETWORK SECURITY AND CRYPTOGRAPHY
(Elective - VII)

Prerequisite: None

Course Objectives:
1. Understand the basic concept of Cryptography and Network Security, their mathematical models
2. To provide deeper understanding of application to network security, threats/vulnerabilities to networks and countermeasures
3. To create an understanding of Authentication functions the manner in which Message Authentication Codes and Hash Functions works
4. To provide familiarity in Intrusion detection and Firewall Design Principles

Course Outcomes:
After completion of this course, the student shall be able to:
1. Describe computer and network security fundamental concepts and principles
2. Identify and assess different types of threats, malware, spyware, viruses, vulnerabilities
3. Encrypt and decrypt messages using block ciphers
4. Describe the inner-workings of today's remote exploitation and penetration techniques
5. Describe the inner-workings of popular encryption algorithms, digital signatures, certificates, anti-cracking techniques, and copy-right protections
6. Demonstrate the ability to select among available network security technology and protocols such as IDS, IPS, firewalls, SSL, SSH, IPSec, TLS, VPNs, etc.
7. Analyze key agreement algorithms to identify their weaknesses


UNIT- IV: Message Authentication and Hash Functions Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs. Hash and Mac Algorithms
MD File, Message digest Algorithm, Secure Hash Algorithm.  
**Authentication Applications**  
Kerberos, Electronic Mail Security: Pretty Good Privacy, S/MIME.  

**UNIT – V: IP Security**  
Overview, Architecture, Authentication, Encapsulating Security Payload, Key Management.  
**Intruders, Viruses and Worms:** Intruders, Viruses and Related threats.  
**Fire Walls:** Fire wall Design Principles, Trusted systems.  

**TEXT BOOKS:**  

**REFERENCE BOOKS:**  
1. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)  
5. Introduction to Cryptography, Buchmann, Springer.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing)  
RADAR SIGNAL PROCESSING  
(Elective - VII)  

Prerequisite: Radar Systems

Course Objectives:
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:

REFERENCE BOOKS:
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing) L T P C

MULTI-MEDIA AND SIGNAL CODING
(ELECTIVE-VIII)

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:

UNIT -II:
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:

REFERENCE BOOKS:
SOFT COMPUTING TECHNIQUES
(Effective - VIII)

Prerequisite: None.

Course Objectives:
This course makes the students to Understand
1. Fundamentals of Neural Networks & Feed Forward Networks.
2. Associative Memories & ART Neural Networks.

Course Outcomes:
On completion of this course the students will be able to
1. Identify and employ suitable soft computing techniques in classification and optimization problems.
2. Design hybrid systems to suit a given real – life problem.

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 Associator, Basic concepts of Dynamical systems, Mathematical Foundation of Discrete-Time Hopfield 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
Types of Hybrid Systems, Neural Networks, Fuzzy Logic, and Genetic Algorithms Hybrid, Genetic Algorithm based BPN: GA Based weight Determination, Fuzzy Back Propagation
Networks: LR-type fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BPN, Inference by fuzzy BPN.

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

REFERENCE BOOKS:
1. Artificial Neural Networks - Dr. B. Yagananarayana, 1999, PHI, New Delhi.
ADVANCED COMPUTER NETWORKS  
(Elective – VIII)

Prerequisite: Computer Networks

Course Objectives:
1. To study the WLAN and WPAN architecture and protocols
2. To know about WiMAX services, 802.16 standard, cellular telephony & satellite networks.
3. To study the techniques to improve QoS in Networks
4. To learn about the basic concepts of Ad hoc wireless Networks
5. To know about various Routing Protocols in Ad hoc Networks.
6. To learn the concepts of Wireless Sensor Networks, architecture and various data dissemination and data gathering techniques

Course Outcomes:
At the end of the course, the student will be able to:
1. Acquire the knowledge about Wireless LANs, Bluetooth and WiMAX standards, architecture and their sub-layers.
2. Understand congestion control mechanisms and techniques to improve Quality of Service in switched networks
3. Get the basic concepts of Ad hoc wireless networks and its protocols and issues related to QoS, energy management, scalability and Security.
4. Explain about Wireless Sensor Network architecture, data dissemination & data gathering techniques and will be able to address the issues and challenges in designing Sensor Networks.

Unit I
Bluetooth: Architecture, Bluetooth Layers

Unit II
Congestion Control and Quality of Service: Data Traffic, Congestion, Congestion Control, Quality of Service, Techniques to Improve QoS, Integrated Services, Differentiated Services, QoS in Switched Networks
Queue Management: Passive-Drop trial, Drop front, Random drop, Active- early Random drop, Random Early detection.

Unit III
Unit IV
Quality of Service in Ad Hoc Wireless Networks:

Unit V
Wireless Sensor Networks

TEXT BOOKS:
2. Data Communications and Networking - B. A.Forouzan, 5th , 2013, TMH.

REFERENCE BOOKS:
1. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
JNTUH COLLEGE OF ENGINEERING HYDERABAD

M.Tech. I Year II-Sem (Systems & Signal Processing)  L   T   P   C
0    0    4   2

ADVANCED COMMUNICATIONS AND NETWORKING LABORATORY

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 provide the intruder statistics.
7. Simulation of Queue Management Schemes.
8. Evaluation of DES, AES and Triple-DES.
10. Error correcting coding in CDMA Mobile communication system.
11. Capturing and tracking of GOLD sequence in CDMA system.
12. Study of Satellite Azimuth & Elevation using sky Plot Window.
SOFT SKILLS LAB
(Activity-based)

Course Objectives

❖ To improve the fluency of students in English
❖ To facilitate learning through interaction
❖ To illustrate the role of skills in real-life situations with case studies, role plays etc.
❖ To train students in group dynamics, body language and various other activities which boost their confidence levels and help in their overall personality development
❖ To encourage students develop behavioral skills and personal management skills
❖ To impart training for empowerment, thereby preparing students to become successful professionals

Learning Outcomes

❖ Developed critical acumen and creative ability besides making them industry-ready.
❖ Appropriate use of English language while clearly articulating ideas.
❖ Developing insights into Language and enrich the professional competence of the students.
❖ Enable students to meet challenges in job and career advancement.

INTRODUCTION

Definition and Introduction to Soft Skills – Hard Skills vs Soft Skills – Significance of Soft/Life/Self Skills – Self and SWOT Analysis and

1. Exercises on Productivity Development
   • Effective/ Assertive Communication Skills (Activity based)
   • Time Management (Case Study)
   • Creativity & Critical Thinking (Case Study)
   • Decision Making and Problem Solving (Case Study)
   • Stress Management (Case Study)

2. Exercises on Personality Development Skills
   • Self-esteem (Case Study)
   • Positive Thinking (Case Study)
   • Emotional Intelligence (Case Study)
   • Team building and Leadership Skills (Case Study)
   • Conflict Management (Case Study)

3. Exercises on Presentation Skills
   • Netiquette
   • Importance of Oral Presentation – Defining Purpose- Analyzing the audience- Planning Outline and Preparing the Presentation- Individual & Group Presentation- Graphical Organizers- Tools and Multi-media Visuals
   • One Minute Presentations (Warming up)
   • PPT on Project Work- Understanding the Nuances of Delivery- Body Language – Closing and Handling Questions – Rubrics for Individual Evaluation (Practice Sessions)

4. Exercises on Professional Etiquette and Communication
   • Role-Play and Simulation- Introducing oneself and others, Greetings, Apologies, Requests, Agreement & Disagreement….etc.
• Telephone Etiquette
• Active Listening
• Group Discussions (Case study)- Group Discussion as a part of Selection Procedure- Checklist of GDs
• Analysis of Selected Interviews (Objectives of Interview)
• Mock-Interviews (Practice Sessions)
• Job Application and Preparing Resume
• Process Writing (Technical Vocabulary) – Writing a Project Report- Assignments

5. Exercises on Ethics and Values

Introduction — Types of Values - Personal, Social and Cultural Values - Importance of Values in Various Contexts
• Significance of Modern and Professional Etiquette – Etiquette (Formal and Informal Situations with Examples)
• Attitude, Good Manners and Work Culture (Live Examples)
• Social Skills - Dealing with the Challenged (Live Examples)
• Professional Responsibility – Adaptability (Live Examples)
• Corporate Expectations

Note: Hand-outs are to be prepared and given to students.
Training plan will be integrated in the syllabus.
Topics mentioned in the syllabus are activity-based.

SUGGESTED SOFTWARE:
The following software from ‘train2success.com’
  o Preparing for being Interviewed
  o Positive Thinking
  o Interviewing Skills
  o Telephone Skills
  o Time Management
  o Team Building
  o Decision making

SUGGESTED READING:
12. *The Hindu Speaks on Education* by the Hindu Newspaper