P14DC101 DETECTION & ESTIMATION THEORY

**Class:** M.Tech. I Semester **Branch:** Digital Communications

**Teaching Scheme:**

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

**Course Learning Objectives:**

- To enable the students to acquire the fundamental concepts of Signal detection and estimation.
- To expose the conceptual basics of Hypotheses.
- To introduce the methods of Detection and estimation of signals in white and non-white Gaussian noise.
- To familiarize with the detection of random signals.
- To enable the students to understand the time varying waveform detection and its estimation.

**UNIT-I (9+3)**


**UNIT-II (9+3)**

**Representation of Random Processes:** Representation of signals-Orthogonal functions-Generalized Fourier series, Gram-Schmidt Orthogonalization Procedure, Representation of random processes; General Gaussian problem-Binary detection, Same Covariance-Diagonal, Non diagonal Covariance Matrix, Same mean-Uncorrelated signal components equal and unequal Variances, Same mean Symmetric Hypothesis-Uncorrelated signal components equal and unequal Variances.

**UNIT-III (9+3)**

**Signal Detection and Parameter Estimation:** Maximum likely hood estimation, Criteria for good estimators, Bayes’ Estimation-Minimum Mean-Square Error Estimate, Minimum Mean Absolute value of Error Estimate, Maximum A Posteriori Estimate. Cramer-Rao Inequality, Multiple parameter Estimation.

**UNIT-IV (9+3)**

Text Books:

Reference Books:

Course Learning Outcomes:
After completion of the course the student will be able to
- Understand the basic concepts of Signal detection and estimation.
- Understand conceptual basics of Hypotheses.
- Understand the conceptual basics of Detection and estimation of signals in white and non-white Gaussian noise.
- Understand the detection of random signals.
- Understand the time varying waveform detection and its estimation.
P14DC102 MODERN DIGITAL COMMUNICATION TECHNIQUES

Class: M.Tech. I Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 40 marks |
| End Semester Exam: | 60 marks |

Course Learning Objectives:
- To introduce various advanced digital communication concepts used as the building blocks for larger and more complex communication systems.
- To provide the basic theoretical elements and technological solutions suitable to design, implement and evaluate modern digital communication systems.
- To enable the student understand digital communication receivers like coherent and non-coherent receivers.
- To provide the properties and features of AWGN channels, Reed-Solomon codes, Viterbi algorithm and spread spectrum signals.

UNIT-I (9+3)
Coherent and Non-Coherent Communication:
Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – Non-coherent receivers in random phase channels; M-FSK receivers – Partially coherent receivers – DPSK; M-PSK; M-DPSK–BER Performance Analysis.

UNIT-II (9+3)
Band-limited Channels and Digital Modulations:
Eye pattern; Demodulation in the presence of ISI and AWGN; Equalization techniques – IQ modulations; QPSK; QAM -BER Performance Analysis – Continuous phase modulation; CPFM, CPFSK, MSK-OFDM.

UNIT-III (9+3)
Space time propagation model, Rayleigh and Rician fading channels, MIMO and SISO modulation, MIMO BC signal model, Time varying fading Channel, Channel estimation using higher order statistical models.

UNIT-IV (9+3)
Spread Spectrum Signals for Digital Communication:

Text Books:
Reference Books:


Course Learning Outcomes:
After completion of the course, the student will be able to

- analyze all the M-ary modulation schemes.
- understand various types of block coding techniques for encoding and decoding.
- apply error control coding for reliable transmission over noisy channels.
- implement various equalization algorithms and understand their responses.
- understand the working principles of existing and advanced digital communication techniques.
- master the basic techniques suitable to understand, design and evaluate the main elements of a modern digital communication systems.
P14DC103 ADVANCED DIGITAL SIGNAL PROCESSING

Class: M. Tech I Semester  Branch: Digital Communications

Teaching Scheme:  

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:  
Continuous Internal Evaluation: 40 marks  
End Semester Examination: 60 marks

Course Learning Objectives:

• To introduce the Advanced Signal Processing Techniques  
• To understand the importance of spectral estimation techniques  
• To design a multi-rate system  
• To impart the concepts of Eigen value analysis techniques

UNIT-I  (9+3)  
Multirate Digital Signal Processing: Decimation, Interpolation, time domain and frequency domain characterization of sampling rate alteration devices, Fractional sampling rate conversion, Direct-form FIR structures, poly phase filter structures, Time-variant filter structures, multistage implementation of sampling rate conversion, design of phase shifters.

Interfacing of digital system: Interfacing with different sampling rates, Implementation of digital filter banks, sub band coding of speech signals, quadrature mirror filters, Trans multiplexers, oversampling ADCs and DACs.

UNIT-II  (9+3)  
Optimal Linear Filters: Representation of stationary random process, rational power spectra, filter parameters and auto correlation sequence. Forward and Backward Predictors: Reflection coefficients, AR process and Linear Prediction, Solution of normal Equations, Levinson & Durbin Algorithm, Properties of Linear Prediction error filters, AR and ARMA lattice Ladder structures.

UNIT-III  (9+3)  
Wavelet Transforms: Introduction to Short Time Fourier Transform (STFT), Definition of Wavelet Transform and its importance in multi-resolution analysis, Wavelet basis function, Mother Wavelet.

Power Spectrum Estimation: Cross correlation and Auto correlation of discrete time signals, power spectral density, periodogram, use of DFT in power spectrum estimation.


UNIT-IV  (9+3)  
Text Books:
4. P. Vaidyanatham, Multirate filter banks, PHI, New Delhi.

Course Learning Outcomes:
After completion of course the student will be able

• To design a real time multi rate system
• To derive relation between wavelet transform, DFT and STFT
• To design and implement various systems like filter banks, implement different means of spectral estimation and apply Digital Signal Processing principles to process speech and Radar signals.
P14DC104  MICROWAVE & OPTICAL FIBER COMMUNICATION SYSTEMS

Class: M.Tech. I Semester  
Branch: Digital Communications

Teaching Scheme:  

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:  

| Continuous Internal Evaluation | 40 marks |
| End Semester Exam | 60 marks |

Course Learning Objectives:  
- To introduce different O-type and M-type microwave tubes.  
- To impart the concepts related to Microwave oscillators and amplifiers.  
- To expose different microwave components and measurements.  
- To introduce the concepts of optical fiber communications.  
- To identify the significance of different Opto-Electric Integrated Circuits (OEICs).

UNIT-I  (9+3)

Microwave Tubes:  

UNIT-II  (9+3)

Waveguide Components:  
**Microwave Measurements:** Description of Microwave Bench - Different blocks and their features, Precautions, Attenuation Measurement, VSWR and Impedance measurement, Phase Shift Measurement.

UNIT-III  (9+3)

Introduction to Fiber Optics:  
Fiber Structures, Nature of light, basic optical laws and definitions, Modes and Configurations, Single, Multi mode step index and Graded Index fibers.  
Optical sources and Detectors: Semiconductors as Optical Sources and their fabrication, LED and Laser Diodes, Linearity of Sources, Power launching and Coupling. Physical principles of PIN and APD, Photo Detector Noise, Detector Response time Avalanche Multiplication Noise and Photo Diode materials, Optical Amplifiers.
UNIT-IV  (9+3)

Optical Fiber Communications: Basic Communication System fundamental receiver operation, Fiber Links: Point to Point Links, Power budget, Time Budget, Line Coding, Eye Pattern, Dispersion compensation techniques, Limitations in High speed and WDM systems due to non-linearities in Fibers.


Text Books:
1. Microwave Devices and Circuits – by Samuel Y.Liao, PHI.

Reference Text Books:

Course Learning Outcomes:
After completion of course the student will be able to
- Understand the basic principles of O-type and M-type microwave tubes which can be used as an amplifier or oscillator
- Gain knowledge of different measuring techniques at Microwave frequencies
- Gain knowledge of different optical sources and detectors
- Understand the fundamental optical fiber receiver operation
- Apply the knowledge of Optical fiber Communication
- Gain the knowledge of Opto-Electric Integrated Circuits (OEIC’s)
P14DC105A  ADVANCED DIGITAL DESIGN  
(Elective - I)

Class: M.Tech. I Semester  
Branch: Digital Communications

Teaching Scheme:  
<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:  
Continuous Internal Evaluation: 40 marks  
End Semester Exam: 60 marks

Course Learning Objectives:
- To focus on detailed study of various building blocks of digital systems at transistor level.
- To focus on FSM and ASM based designs.
- To introduce Verilog hardware description language for developing and verifying designs of digital circuits.
- To elaborate on structure and applications of various PLDs.

UNIT-I (9+3)

Digital Integrated System Building Blocks:
Multiplexors and Decoders, Barrel Shifters, Counters, Digital Adders, Digital Multipliers, Programmable Logic Arrays.

Latches, Flip-Flops, and Synchronous System Design:

UNIT-II (9+3)

Finite State Machines: Moore and Mealy machines, Case studies, sequence detector.
Design case studies: Binary multiplier, count number of ones, TLC.

UNIT-III (9+3)

Digital Design using Verilog HDL:
Introduction to HDL - language elements, Identifiers, operators, data types, types of model, Structural Gate-level, Behavioral, Dataflow and Switch-level.
Design using HDL- Adders, Multiplexers, decoders, Flip-flops, Counters, Shift registers.

UNIT-IV (9+3)

Programmable Logic Devices:
ROM: Internal ROM Structure, Applications of ROM, Static-RAM Structure, Dynamic-RAM Structure, CPLD, FPGA.

Text Books:
Reference Books:
1. “Switching Theory and Logic Design” by Anand Kumar, PHI

Course Learning Outcomes:
After completion of the course, the students will be able to

- Get an in-depth knowledge of digital design.
- Design complex digital designs using contemporary design techniques, hardware description language (HDL) and professional CAD tools.
- Express a digital design in Verilog HDL and synthesize the design in programmable logic.
- Use standard digital memory devices as components in complex subsystems.
P14DC105B ARTIFICIAL NEURAL NETWORKS
(Elective - I)

Class: M. Tech I Semester Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

Continuous Internal Evaluation: 40 marks
End Semester Examination: 60 marks

Course Learning Objectives:

- To introduce the fundamental concepts of Artificial Neural Networks.
- To focus on learning rules of neural networks.
- To introduce Bidirectional Associate Memory and Hopfield Memory.
- To focus on stochastic networks and Simulated Annealing, working of Boltzman machine and its learning.
- To introduce the concepts of competitive learning network and adaptive resonance theory.

UNIT-I (9+3)

Fundamental Concepts and Models of Artificial Neural Networks:

UNIT-II (9+3)

Bidirectional associative memory and Hopfield memory:
Associative Memory definitions, Hamming distance, linear Associator, Bidirectional Associative Memory Architecture, Processing and Energy function. Discrete Hopfield memory, Continuous Hopfield memory, traveling salesman problems.

UNIT-III (9+3)

Stochastic networks and simulated annealing:

UNIT-IV (9+3)

Competitive learning network:
Components of Competitive learning network, basic learning rules, Description of Kohonen’s neural network, Learning rule and parametric selection. Adaptive resonance theory:
ART1, ART2 network description and learning rules.
Text Books:
1. Zurada, Artificial Neural Networks, TMH, NewDelhi
3. Yegnanarayana. B, Artificial Neural Networks. PHI.

Reference Books:

Course Learning Outcomes:
After completion of the course, the student will be
- Able to design and define the learning of Artificial Neural Networks in feed forward and feedback networks.
- Familiarized with the concepts of Bidirectional Associate Memory and Hopfield Memory.
- Able to learn about Stochastic networks and Simulated Annealing and working of Boltzman machine with machine learning.
- Able to learn the concepts of competitive learning network and adaptive resonance theory.
P14DC105C  EMBEDDED SYSTEM DESIGN  
( Elective - I )

Class: M.Tech. I Semester  
Branch: Digital Communications

Teaching Scheme:  

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:  

| Continuous Internal Evaluation: 40 marks | End Semester Exam: 60 marks |

Course Learning Objectives:
- To emphasize on the basic concepts and building Blocks for Embedded Systems.
- To expose the students to the fundamentals of microcontroller based system design.
- To introduce I/O and RTOS role in microcontroller.
- To impart knowledge on PIC Microcontroller based system design.
- To introduce the architecture and programming of 16-bit RISC processor.

UNIT-I  
9+3

EMBEDDED DESIGN WITH MICROCONTROLLERS:
Product specification - Hardware/software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Microcontroller - Performance tools -  
Bench marking - RTOS Micro Controller - issues in selection of processors.

UNIT-II  
9+3

8051 PROGRAMMING:

UNIT-III  
9+3

PIC MICROCONTROLLER:

UNIT-IV  
9+3

ARM ARCHITECTURE AND PROGRAMMING:
Text Books:

Reference Books:

Course Learning Outcomes:
After completion of the course, the student will be able to
- understand the basics of an embedded system.
- learn efficient coding techniques for embedded systems.
- appreciate various considerations of embedded systems design like – specification; technological choice; the development process; technical, economic, environmental and manufacturing constraints; reliability, security and safety issues.
- learn the modern hardware/software tools for building prototypes of embedded systems.
- estimate if additional hardware can accelerate a system.
UNIT-I (9+3)


UNIT-II (9+3)


UNIT-III (9+3)


UNIT-IV (9+3)

Circuit Design techniques and SRAM Architecture:

Text Books:
**Reference Books:**

**Course Learning Objectives:**

> After completion of the course, the students will be able to

- understand the issues related to power consumption in ICs.
- use power analysis algorithms and computer-aided tools.
- acquire an ability to apply low power design methods to digital electronic circuits.
- understand circuit design techniques and SRAM Architectures.
P14DC106A  DATA COMPRESSION TECHNIQUES  
(Elective - II)  

Class: M.Tech. I Semester  
Branch: Digital Communications  

Teaching Scheme  
<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:  
Continuous Internal evaluation: 40 marks  
End semester Exam 60 marks  

Course Learning Objectives:  
- To enable the students to acquire the fundamental knowledge about different compression techniques.  
- To introduce the concept of optimal and adaptive waveform for speech and image.  
- To emphasize the audio and video compression techniques for digital broadcasting.  
- To acquire knowledge about digital signal compression standards for data, speech, image, audio and video.  

UNIT-I  (9+3)  

UNIT-II  (9+3)  
Private coding-DPCM, Linear prediction, prediction for video, Adaptive prediction, motion compensation for video  

UNIT-III  (9+3)  
Transform coding: Orthogonal transforms- Fourier, Cosine, Wavelet based approaches to speech & image compression.  

UNIT-IV  (9+3)  

Text Books:  

Course Learning Outcomes:  
After completion of the course, the student will be able to  
- Understand the speech and image waveform characterizations.  
- Understand the basic compression techniques for speech and image.  
- Know the standards of data, speech, audio, image and video signals for digital signal compression.  
- Know the high quality audio and video compression for digital broadcasting.
P14DC106B  DIGITAL DESIGN FOR TESTABILITY  
(Elective - II)  

Class: M.Tech. I Semester  
Branch: Digital Communications  

Teaching Scheme:  

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:  
Continuous Internal Evaluation: 40 marks  
End Semester Exam: 60 marks  

Course Learning Objectives:  
- To focus on Programmable Logic, Finite state machine and Algorithmic state machine based designs to construct high level modules.  
- To provide students with an understanding of fault tolerant concepts, including both the theory of how to design and evaluate them and the practical knowledge of real fault tolerant systems.  
- To elaborate on design verification and testing issues.  
- To introduce fault modelling techniques in digital system design.  
- To introduce the concept of PLA Folding and Minimization  

UNIT-I  (9+3)  
Designing with Programmable Logic Devices:  
Designing with Read only memories - Programmable Logic Arrays - Programmable Array logic - Sequential Programmable Logic Devices - Design with FPGA’s- Using a One-hot state assignment, State transition table- State assignment for FPGA’s - Problem of Initial state assignment for One –Hot encoding - State Machine charts - Derivation of SM Charts - Realization of SM charts - Design Examples -Serial adder with Accumulator - Binary Multiplier - Signed Binary number multiplier (2’s Complement multiplier) – Binary Divider - Control logic for Sequence detector - Realization with Multiplexer - PLA - PAL.  

UNIT-II  (9+3)  
Fault Modelling & Test Pattern Generation:  

UNIT-III  (9+3)  
Fault Diagnosis in Sequential Circuits:  

UNIT-IV  (9+3)  
PLA Minimization and Testing:  
PLA Minimization – PLA folding, Fault model in PLA, Test generation and Testable PLA Design.
Text Books:
3. Logic Design Theory – N. N. Biswas, PHI

Reference Books:

Course Learning Outcomes:
Upon successful completion of the course, students will be able to:
- Construct high level modules using Programmable Logic, Finite State Machine and Algorithmic State Machine based designs.
- Get an in-depth knowledge of Advance digital System design.
- Design fault models for combinational and sequential circuits.
- Verify testability of a design based on given testability requirements.
- Minimize PLAs using PLA folding techniques.
P14DC106C DATA & COMPUTER COMMUNICATIONS  
(Elective - II)

Class: M.Tech. I Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

- Continuous Internal Evaluation: 40 marks
- End Semester Exam: 60 marks

Course Learning Objectives:
- To introduce baseband and M-ary modulation/demodulation, and Symbol error rate.
- To expose Adaptive Equalization techniques.
- To study Synchronization and Digital communications in fading channels.
- To study the basic concepts of communication networks, protocols and their performance.
- To solve the problems related to switching techniques.
- To study the satellite network architecture and protocols.

UNIT-I (9+3)

Overview of Data Communications and Networking: Data Communication Networks- Physical structures, Protocols and standards, Layered tasks, Five layer Internet model, OSI model

Multiple Access: Random access, Multiple access, Aloha- Carrier Sense Multiple Access (CSMA), 1 and p-persistent 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.

UNIT-II (9+3)

Fading: Digital Signaling over multi path fading channels, characterization of time varying frequency selective channels, binary signaling over frequency non-selective fading channel.

UNIT-III (9+3)

Data Communication Networking: Computer communication architecture, Data link control line configuration, flow control, error control, Stop and wait ARQ, Go Back N ARQ, Selective Repeat ARQ, bit-oriented link control (HDLC).


UNIT-IV (9+3)

Satellite Networks: satellite network architecture, channel access protocols, local networks: technology Bus/Tree topology, ring topology, medium access control protocols and protocol performance.
Text Books:

Course Learning Outcomes:
After completion of the course the student will be able to

- learn the basic concepts of M-ary and Adaptive equalization techniques
- learn about the digital communications in fading channels
- get familiarized with the concept of LANs and switching techniques in network management
- learn about the satellite networks and protocols
P14DC106D  NEURO-FUZZY MODELING
(Elective - II)

Class: M. Tech I Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

Continuous Internal Evaluation: 40 marks
End Semester Examination: 60 marks

Course Learning Objectives:

• To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
• To explain the concepts of neural networks with the help of examples and generalize to form appropriate rules for inference systems.
• To provide the mathematical background for carrying out the optimization associated with neural network learning.
• To introduce genetic algorithms and other random search procedures useful while seeking global optimization in self-learning situations.

UNIT-I  (9+3)

FUZZY SET THEORY:

UNIT-II  (9+3)

OPTIMIZATION:

UNIT-III  (9+3)

NEURAL NETWORKS:
Supervised Learning Neural Networks - Perceptrons - Adaline – Backpropagation Mutilayer Perceptrons - Radial Basis Function Networks - Unsupervised Learning Neural Networks - Competitive Learning Networks - Kohonen Self-Organizing Networks - Learning Vector Quantization – Hebbian Learning

UNIT-IV  (9+3)

NEURO FUZZY MODELING:
Text Books:

Reference Books:

Course Learning Outcomes:
After completion of the course, the student will
• get the concepts of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
• be familiar with neural networks that can be learned from available examples and generalize to form appropriate rules for inferencing systems.
• get the mathematical background for carrying out the optimization associated with neural network learning.
• get familiarized with genetic algorithms and other random search procedures useful while seeking global optimization in self-learning situations.
P14DC107 ADVANCED DIGITAL SIGNAL PROCESSING LABORATORY

Class: M.Tech. I Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Course learning objectives:

- To develop students' ability to solve problems on multi-rate signal processing using simulation software.
- To develop students' ability to find autocorrelation, cross correlation & power spectrum estimation of different random processes with parametric & nonparametric methods using simulation software.

Examination Scheme:

| Continuous Internal Evaluation: | 40 marks |
| End Semester Exam: | 60 marks |

LIST OF EXPERIMENTS

MATLAB Program for:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Name of the Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plotting Interpolated version of a sinusoidal signal both in time domain &amp; frequency domain</td>
</tr>
<tr>
<td>2</td>
<td>Plotting Decimated version of a sinusoidal signal both in time domain &amp; frequency domain</td>
</tr>
<tr>
<td>3</td>
<td>Program To compute the order of the linear phase FIR filter using Kaiser’s formulae</td>
</tr>
<tr>
<td>4</td>
<td>Program to compute the order of the linear phase FIR filter using Remezord function</td>
</tr>
<tr>
<td>5</td>
<td>Program to plot approximate and dedicated coefficients of a speech signal using DWT of 4 levels</td>
</tr>
<tr>
<td>6</td>
<td>Plot Periodogram Estimation of Additive White noise</td>
</tr>
<tr>
<td>7</td>
<td>Periodogram Estimation of noise corrupted signal using Bartlett method</td>
</tr>
<tr>
<td>8</td>
<td>Periodogram Estimation of noise corrupted signal using Welch Method</td>
</tr>
<tr>
<td>9</td>
<td>Periodogram estimation of noise corrupted signal using Blackman Tukey Method</td>
</tr>
<tr>
<td>10</td>
<td>Periodogram Estimation of noise corrupted signal using AR model</td>
</tr>
<tr>
<td>11</td>
<td>Periodogram Estimation of noise corrupted signal using MA model</td>
</tr>
<tr>
<td>12</td>
<td>Periodogram Estimation of noise corrupted signal using ARMA model</td>
</tr>
<tr>
<td>13</td>
<td>Plot Additive White Noise with a Variance of 1/12 and its Auto Correlation for 15 lags</td>
</tr>
<tr>
<td>14</td>
<td>Plot Periodogram Estimation of Additive White noise</td>
</tr>
</tbody>
</table>

Course Learning Outcomes:

After completion of the course, the student will be able to

- Solve problems on multi rate signal processing.
- Find autocorrelation, cross correlation & power spectrum estimation of different random processes using parametric & nonparametric methods.
P14DC108  MICROWAVE & OPTICAL FIBER COMMUNICATION SYSTEMS LAB

Class: M.Tech. I Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Examination Scheme:

<table>
<thead>
<tr>
<th>Continuous Internal Evaluation</th>
<th>40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>End semester Exam:</td>
<td>60 marks</td>
</tr>
</tbody>
</table>

Course Learning Objectives:

- To verify the characteristics of Microwave oscillator.
- To measure VSWR and Reflection coefficient.
- To gain hands-on-experience of different waveguide components.
- To verify and compare the concepts of optical fiber communications.

LIST OF EXPERIMENTS

1. Mode characteristics of Reflex Klystron
2. Study of Gunn Oscillator
3. Measurement of Frequency and Wave length
4. Measurement of VSWR and Reflection Coefficient
5. Measurement of Impedance
6. Study of Multi Hole Directional Coupler
7. Study of Magic Tee
8. Study of Isolator and Circulator
9. Study of Numerical Aperture in optical fiber
10. Study of Misalignments in optical fiber
11. Study of losses in optical fiber
12. Study of Eye Pattern for optical link
13. Measurement of Bit Error Rate for optical communication link

Course Learning Outcomes:

After completion of course the students will be able to

- Understand the characteristics of reflex klystron and Gunn oscillator
- Gain knowledge of different measuring techniques at Microwave frequencies
- Understand measurement of different parameters of waveguide components
- Gain knowledge of misalignments and losses in optical fiber.
- Understand the fundamental optical fiber receiver operation
- Apply the knowledge of Optical fiber Communication
P14DC109 SEMINAR

Class: M. Tech I Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 100 marks |
| End Semester Examination:       | -         |

There shall be only Continuous Internal Evaluation (CIE) for Seminar, which includes Report Submission & Presentation.

A teacher will be allotted to a student for guiding in
(i) Selection of topic
(ii) Report writing
(iii) Presentation (PPT) before the DPGRC
P14DC201 COMMUNICATION SYSTEM MODELING

Class: M.Tech. II Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 40 marks |
| End Semester Exam | 60 marks |

Course Learning Objectives:

- To interpret, analyze, model and process the communication signals, systems using appropriate modeling techniques and simulation tools.
- To analyze and evaluate a communication system and suggest enhancements to improve the system performance.
- To apply suitable tools to design, simulate and demonstrate the working of communication systems and signal processing as per the application needs.
- To specify and design optimal modeling schemes for the given communication system problem to efficiently use the channel capacities and signal characteristics.

UNIT-I (9+3)

Introduction: Identifying the role of simulation in Communication Systems, Understanding analytically tractable and intractable systems, deterministic and stochastic simulations with examples, Mapping a problem into simulation model, system level modeling of timing recovery subsystem, linear vs nonlinear models, random process modeling and simulation, BER estimation.

Quadrature Models: Low pass and band pass sampling, Up sampling and down sampling, simulation sampling frequency, Low pass simulation model for band pass signals and systems, low pass complex envelope - time domain and frequency domain representation, quadrature models for random band pass signals, Linear band pass systems, LTI systems, derivation of LPEQ components, Multi carrier signals, Nonlinear systems, time variant systems.

UNIT-II (9+3)

Digital Filter models: Models and simulation techniques, CAD of IIR digital filters, PLLmodels, Nonlinear phase model, simulating the PLL.

Random Signal Models: Generating and Processing random signals, uniform random number generators, testing the random number generators, Mapping uniform RVs to an arbitrary pdf, generating uncorrelated Gaussian random numbers, generating correlated Gaussian random numbers, PN sequence generators, Post processing, Graphical techniques, Histogram estimation, PSD estimation, Gain, Delay, SNR.

UNIT-III (9+3)

Monte Carlo methods: Monte Carlo estimation, Application to communication systems, Monte Carlo simulation of PSK and QPSK systems, Semi analytic BER estimation for PSK and QPSK systems.

UNIT-IV (9+3)

Advanced Models: Modeling and simulation of baseband and band pass non linearities, Multi carrier case, Modeling and simulation of time varying systems, time and frequency descriptions of LTV systems, Modeling and simulation of waveform channels, multipath fading channel example, CASE STUDY – Modeling and Simulation of a cellular radio system, CCI and effects of sectoring, Generation of snapshots and SIR computation.

Text books:
Course Learning Outcomes:

After completion of the course, the student will be able to

- Understand the concepts Quadrature Models, Random Signal Models and Monte Carlo methods
- Interpret, Analyze, model and Process the communication signals, systems using appropriate modeling techniques and simulation tools
- Analyze and evaluate a communication system and suggest enhancements to improve the system performance.
- Apply suitable tools to design, simulate and demonstrate the working of communication systems and signal processing as per the application needs.
- Specify and design optimal modeling schemes for the given communication system problem to efficiently use the channel capacities and signal characteristics.
### Course learning objectives:

- To introduce the basic elements of digital communication with Galois fields using abstract algebra.
- To elaborate different encoding and decoding techniques like linear block codes, cyclic codes, convolutional codes and some channel coding theorems.
- To familiarize the students with BCH codes and some coding algorithms.
- To impart the convergence and distance properties of LDPC codes, Turbo codes and Reed-solomon codes.
- To study the importance of Reed muller and Golay codes.
- To acquire the knowledge of various coding theory techniques in applications like Digital video broadcasting, mobile communication and digital radio system.

### UNIT-I (9+3)

Introduction to abstract algebra: Fields, Galois Fields(GF), construction of external field, GF arithmetics, Polynomials, Linear block codes, syndrome decoding, Maximum likelihood decoding, Hard decision decoding and soft decision decoding. 

Elements of Digital Communication System: Channel models, Shannon’s noisy channel coding theorem, Weight enumerators and MacWilliam’s theorem.

### UNIT-II (9+3)

Introduction to cyclic codes, Encoding and Decoding of Cyclic codes, Encoding structural & distance properties of convolutional codes, sequential decoding of convolutional codes, Bose Chaudhury & Hocquenghem(BCH) codes, decoding of binary BCH codes, Berlekamp – Massey algorithm, Euclids algorithm.

### UNIT-III (9+3)

Introduction to Reed solomon codes, decoding of Reed solomon codes, Low density parity-check(LDPC) codes, desirable properties, constructing LDPC codes, Decoding of LDPC codes, Turbo codes: Turbo algorithm, convergence properties of the turbo algorithm, Distance properties of turbo codes.

### UNIT-IV (9+3)

Introduction to Reed muller and Golay codes, Application of Block codes in Digital Video Broadcasting(DVB),Mobile communication, Digital radio system, compact disc and Space probe communication.

### Text books:


### Course Learning Outcomes:

After successful completion of the course, the student will be

- In a position to find solutions to the problems associated with Galois fields.
- Acquainted with basic block codes, cyclic codes, convolutional codes and BCH codes.
- Able to gain knowledge of hard decision, soft decision codes, Turbo codes and LDPC codes.
- Easily differentiate the specific application of specific code.
- Able to apply encoding techniques for Mobile applications and Space communication.
P14DC203 ADAPTIVE SIGNAL PROCESSING

Class: M. Tech II Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

- Continuous Internal Evaluation: 40 marks
- End Semester Examination: 60 marks

Course Learning Objectives:

- To introduce Adaptive filters and their applications.
- To analyse the optimization techniques.
- To know the importance and characteristics of autocorrelation matrix and eigenvalue analysis.
- To use model-based signal processing methods in communications.
- To model systems like multipath communication channel.

UNIT-I  (9+3)
Fundamentals Adaptive Signal processing: General form of adaptive linear combiner, optimum Wiener filtering, performance surface, principle of orthogonality, gradient and minimum mean-square error, input correlation matrix, eigenvalues and eigenvectors of correlation matrix, Basic applications of adaptive filtering.

UNIT-II  (9+3)

UNIT-III  (9+3)
Least Squares Algorithm: Recursive Least Squares (RLS) and exponentially weighted RLS.

UNIT-IV  (9+3)
Kalman Filter Theory: Recursive minimum mean square estimation of scalar random variables, statement of the Kalman filtering problem, innovation process, estimation of state using the innovation process. Application of Kalman filters to target tracking and channel equalization.

Text Books:


Course Learning Outcomes:

After completion of the course the student will be able to

- implement the adaptive filter algorithms.
- implement the gradient based optimization techniques.
- apply adaptive techniques in real-time communication problems like channel estimation and channel equalization.
P14DC204 RADAR SIGNAL PROCESSING

Class: M.Tech. II Semester Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 40 marks |
| End semester Exam | 60 marks |

Course Learning Objectives:
- To introduce the concepts of radar signal processing.
- To represent different types of radar signals.
- To elaborate the concept of matched filter receiver and importance of Ambiguity function.
- To make students understand different modulation techniques (LFM, Poly-phase coded signals).
- To study clutter models.
- To impart the knowledge regarding wide applications of Satellite technology.

UNIT-I (9+3)

UNIT-II (9+3)

UNIT-III (9+3)
Range and Doppler resolution: Ambiguity function and its properties. Local and Global Accuracy. Signal Design. LFM. Polyphase coded signals detection of a Doppler shifted slowly fluctuating point target return in a discrete scatterer environment.

UNIT-IV (9+3)

Reference Books:
Course Learning Outcomes:

After completion of course the students will be able to

- Understand the basic principles of radar, signal processing concepts.
- Gain knowledge of different subsystems of radar
- Design matched filters, non-coherent filter receivers.
- Apply the knowledge of Classical Detection and Estimation theory
- Gain the knowledge of fading Target and Clutter models.
P14DC205A DSP PROCESSORS
(Elective - III)

Class: M. Tech II Semester

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Branch: Digital Communications

Examination Scheme:

<table>
<thead>
<tr>
<th>Continuous Internal Evaluation:</th>
<th>40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Semester Examination:</td>
<td>60 marks</td>
</tr>
</tbody>
</table>

Course Learning Objectives:

• To introduce the basic differences between conventional microprocessors and DSP processors.
• To elaborate the architectural features of DSP processors.
• To apply DSP theory to real-world situations.

UNIT-I (9+3)

Introduction: Comparison between general purpose and Digital Signal Processors, need for specialized processors, RISC and CISC.

Data formats: Number formats for signal and coefficients in DSP systems. Dynamic range and precision, sources of error in DSP implementations: A/D conversion errors, DSP computational errors, and D/A conversion errors, Compensating filter.

UNIT-II (9+3)

Architecture 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.

Execution Control and Pipelining: Hardware looping, interrupts, stacks, relative branch support, pipelining and performance, pipeline depth, interlocking, branching effects, pipeline programming. Control-unit of DSP’s, Pipelined instruction execution, specialized hardware for zero-overhead looping.

UNIT-III (9+3)

Programmable Digital Signal processors: Key features of TMS320C54X, Architecture and addressing modes, Instruction set, programming, pipelining, parallelism, on-chip peripherals and interrupts of 54x processor.

UNIT-IV (9+3)

DSP Tools: Assembler, Debugger, C-Compiler, Linker, Editor, Code Composer studio (CCS).

Applications of DSP algorithms: FFT, FIR, IIR, Adaptive and multirate filters.

Text Books:


Course Learning Outcomes:

After completion of the course student will be able to

• Describe the specific architecture of the DSP processor, and understand the architecture of similar commercially produced DSP processors.
• Discuss the various issues that need to be addressed when implementing DSP algorithms in real hardware with finite resources such as processing speed, memory and bit resolution.
• Write assembler code to implement basic DSP algorithms such as linear filtering with FIR and IIR filters.
P14DC205B SATELLITE COMMUNICATIONS
(Selective - III)

Class: M.Tech. II Semester
Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

<table>
<thead>
<tr>
<th>Continuous Internal Evaluation: 40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>End semester Exam 60 marks</td>
</tr>
</tbody>
</table>

Course Learning Objectives:

- To introduce the concepts of satellite communications.
- To elaborate the concepts of orbital parameter.
- To enable the student understand different amplifiers and transponders.
- To make students understand different modulation techniques
- To study Link Analysis.
- To impart the knowledge regarding wide applications of Satellite technology

UNIT-I (9+3)

The evaluation and growth of communication satellites; other satellite systems, kepler’s laws of motion, Orbital Parameters, geostationary orbits, placing a satellite in stationary orbit, choice of frequency bands propagation characteristics, Effects of Doppler, Eclipse, Sun transit etc, Noise and attenuation.

UNIT-II (9+3)

Earth segment, Space segment, satellite transponders, Subsystems of a communication satellite. Satellite control, Solar cells and panels, antennas, Low noise amplifiers, High Power amplifiers. Earth station, G/T, C/N, link calculation, C/N for the complete link, and design of communication systems via satellites.

UNIT-III (9+3)

Modulation, Multiplexing and multiple access techniques; TDMA, FDMA,CDMA,SSMA Reliability, Redundancy; Quality assurance, Echo control and Echo suppression.

UNIT-IV (9+3)

Laser Satellite Communication, Link Analysis, Optical satellite link transmitter, Receiver, Satellite, Beam Acquisition, Tracking and pointing, Deep space optical communication link Introductory concepts of VSATS, GIS,GPS and Future trends.

Reference Books:

Course Learning Outcomes:
After completion of course the students will be able to

- Understand the basic principles of satellite communication, geostationary orbits and ionosphere properties.
- Gain knowledge of different subsystems of satellite.
- Design of communication systems via satellites with high precision.
- Compare TDMA, FDMA,CDMA,SSMA Reliability.
- Apply the knowledge of Laser Satellite Communication.
- Gain the knowledge of Laser Satellite Communication, VSATS, GIS and GPS.
P14DC205C RADIO NAVIGATIONAL AIDS
(Elective - III)

Class: M. Tech. II Semester
Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

<table>
<thead>
<tr>
<th>Continuous Internal Evaluation:</th>
<th>40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>End semester Exam</td>
<td>60 marks</td>
</tr>
</tbody>
</table>

Course Learning Objectives:
- To introduce the concept of radio navigation systems.
- To elaborate different approaches to navigational aids.
- To study about the inertial navigation system and internal sensors.
- To impart the concepts and applications of GPS and errors.
- To study satellite navigation.
- To study different applications of Radio navigational Aids and to study mapping and geographical information systems.

UNIT-I  (9+3)


UNIT-II  (9+3)


UNIT-III  (9+3)

Global positioning system (GPS) for Navigation: Overview of GPS, Reference systems. Satellite orbits, Signal structure, Geometric dilution of precision (GDOP, or Precision dilution of precision (PDOP), Satellite ephemeris, Satellite clock, I onospheric group delay. Tropospheric group delay, Multipath errors and Receiver measurement errors.

UNIT-IV  (9+3)

Differential GPS and WAAS: Standard and precise positioning service local area DGPS and Wide area DGPS errors, wide area augmentation system (WAAS) architecture, Link budget and Data capacity, ranging function, precision approach and error estimates, GPS Navigational Applications.

Reference Books:

Course Learning Outcomes:
After completion of the course student will be able to
- understand the different concepts of navigation.
- know about the Ground controlled approach system.
- know Gyroscopes, Laser gyro, fiber optic gyro and accelerometers.
- know the INS components, transfer function and errors.
- design satellite based navigational system with high accuracy.
- know Differential GPS and WAAS.
- know wide applications of navigational system like, Air and Land Navigation, Surveying, military & space.
P14DC205D MULTIMEDIA COMMUNICATIONS & SYSTEM DESIGN
(Elective - III)

Class: M.Tech. II Semester

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 40 Marks |
| End Semester Exam: | 60 Marks |

Course Learning Objectives:

- To provide the foundation knowledge of multimedia computing, e.g. media characteristics, Compression standards, multimedia representation, data formats, multimedia technology development.
- To describe the ways in which multimedia information is captured, processed and rendered.
- To study the technical issues and system solutions for providing multimedia Communications on the Internet.
- To introduce the concepts to differentiate text, image, video & audio
- To provide in-depth knowledge about Image and Video Compression

UNIT-I (9+3)

UNIT-II (9+3)

UNIT-III (9+3)
Distributed multimedia systems, Resource management of DMS, IP networking, Multimedia operating systems, distributed multimedia servers & applications. Multimedia communication standards.

UNIT-IV (9+3)
Multimedia communication across networks. Compression Techniques: JPEG, MPEG

Reference Text Books:


Course Learning Outcome:

After completion of the course the student will be able to

- Understand the current state-of-the-art developments in Internet technologies for multimedia communications.
- Capable of applying the principles used in designing multimedia protocols, and so understand why standard protocols are designed the way that they are.
- Understand the system design principles of multimedia communications systems.
- Solve problems and design simple networked multimedia systems.
- understand and differentiate text, image, video & audio
- In the coding aspect, state-of-the-art compression technologies will be presented.
P14DC206A STATISTICAL SIGNAL PROCESSING
(Elective - IV)

Class: M. Tech II Semester
Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

<table>
<thead>
<tr>
<th>Continuous Internal Evaluation:</th>
<th>40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Semester Examination:</td>
<td>60 marks</td>
</tr>
</tbody>
</table>

Course Learning Objectives:

- To introduce the probability theory of communication signals
- To design the key functionalities of a communication receiver and in particular its equalizer
- To analyze linear estimation, adaptive signal processing and multi-antenna signal processing.

UNIT-I (9+3)


UNIT-II (9+3)

Linear Algebra Basics: Concepts of Vector Space, Linear Operators on finite dimensional vector spaces, Deionization of Auto-Covariance Matrix (Concept of positive definiteness, Eigen Vector Concept etc). Random signal modelling: MA(q), AR(p), ARMA(p,q) models.

UNIT-III (9+3)


UNIT-IV (9+3)


Text Books:

Reference Books:

Course Learning Outcomes:
After completion of the course, the student will be able to
- use the methodology of signal processing to design communication systems and their receivers.
- design and implement various equalizer algorithms.
- estimate the complexity of various equalizer algorithms.
P14DC206B ADHOC & WIRELESS SENSOR NETWORKS
(Elective - IV)

Class: M.Tech. II Semester
Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 40 Marks |
| End Semester Exam: | 60 Marks |

Course Learning Objectives:

- To expose the students to the concepts of the 802.11 Wireless LAN (Wi-Fi) and Bluetooth standards. This includes their designs, operations, plus approaches to interoperability.
- To introduce the principles of ad hoc wireless networks, design and implementation issues, and available solutions.
- To enable the student to acquire fundamental knowledge of MAC protocols for Adhoc networks.
- To introduce the basic concepts of routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid.
- To elaborate the concepts related to transport layer and security protocols of Adhoc wireless networks.
- To familiarize issues and challenges in providing QOS and QOS solutions for Adhoc wireless networks.
- To impart knowledge on energy management in Adhoc networks.
- To gain basic knowledge of sensor networks and their characteristics. This includes design of MAC layer protocols, location discovery and issues.

UNIT-I (9+3)


UNIT-II (9+3)


UNIT-III  (9+3)


ENERGY MANAGEMENT: Introduction, need for energy Management in Adhoc wireless networks, classification of Adhoc wireless networks, Battery Management schemes, Transmission power Management scheme, System power management schemes.

UNIT-IV  (9+3)


Reference Text Books:


Course Learning Outcomes:

After completion of the course, the student will be able to

- know the layers of the Wi-Fi standard and its functions
- Understand the layers of the Bluetooth standard and its functions
- Understand the principles of ad hoc networks and what distinguishes them from infrastructure-based networks.
- Understand how proactive, reactive and hybrid routing protocols function and their implications on data transmission delay and bandwidth consumption.
- Understand MAC and transport layer protocols.
- know the mechanisms for implementing security mechanisms in adhoc networks.
- Understand QOS issues and solutions related to adhoc networks
- know the energy management in adhoc networks
- Understand the principles and characteristics of wireless sensor networks (WSNs).
- Understand the limitations of wireless sensor networks and the work needed to develop real-life applications.
- Understand the current topics in adhoc wireless and sensor networks both from an industry and research point of views. design their own wireless network.
P14DC206C DIGITAL IMAGE PROCESSING  
(Elective - IV)  

Class: M. Tech II Semester  
Branch: Digital Communications  

Teaching Scheme:  

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:  
Continuous Internal Evaluation: 40 marks  
End Semester Examination: 60 marks  

Course Learning Objectives:  
- To provide the student with the fundamentals of digital image processing.  
- To acquire a good knowledge in Digital image processing including the topics of filtering, transforms, morphology, image analysis and compression.  
- To introduce the students about some advanced topics in digital image processing.  
- To give the students a useful skill base that would allow them to carry out further study in the field of Digital Image Processing.  

UNIT-I (9+3)  
Introduction: Elements of Digital Image Processing system, Digital Image representation, Image model, Sampling and Quantization, Neighbors of pixel, Connectivity, Distance measures, Arithmetic and Logical operations on images, Basic Transformations such as translation, Scaling, Rotation, Perspective Transformations  
Image Transforms: Two dimensional DFT and its properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling (K-L) Transform  

UNIT-II (9+3)  
Image Enhancement: Brightness and contrast of an image, Simple intensity transformations – Image negatives, Linear mapping, logarithmic mapping, Gray level thresholding; Image histograms, histogram equalization, histogram specification, local enhancement; Spatial filtering: smoothing filters – low pass, Rank filters, Median filters, min-max and range filters; sharpening filters – high pass, high boost and Derivative filters; Enhancement in frequency domain, Image restoration techniques.  

UNIT-III (9+3)  
Image Compression: Redundancy – Coding redundancy, interpixel redundancy, Psychovisual redundancy; Root mean square error, Image compression system model, noiseless and noisy coding, error free compression – Huffman coding, Bit-plane coding, constant area coding, lossless predictive coding; Lossy compression – Lossy predictive coding, Transform coding, JPEG coding standards.  

UNIT-IV (9+3)  
Image Segmentation: Detection of discontinuities – Point detection, line detection, Edge detection, pixel connectivity; Region – Oriented segmentation – Region similarity, Region growing, Limitations of region growing, Region splitting and Merging. Segmentation with moving curves with PDE’s. Morphological Image Processing – Fitting and Hitting, Dilation and Erosion, opening and closing, Hit or Miss Transform, Basic Morphological Algorithms, grey-scale morphology.  

Text Books:  
2. B.chanda, D.Dutta Majumder, Digital image processing and analysis, Prentice Hall of India, New Delhi.  
Course Learning Outcomes:

After completion of the course, the student will

- Understand the fundamentals of Digital image processing including the topics of filtering, transforms and morphology, and image analysis and compression.
- Be able to implement basic image processing algorithms in MATLAB.
- Have the skill base necessary to further explore advanced topics of Digital Image Processing.
- Be in a position to make a positive professional contribution in the field of Digital Image Processing.
**PI4DC206D QUANTUM COMMUNICATIONS**  
(Elective - IV)

**Class:** M.Tech. II Semester  
**Branch:** Digital communications

<table>
<thead>
<tr>
<th>Teaching Scheme:</th>
<th>Examination Scheme:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>T</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Course learning objectives:**
- To enable the students to acquire fundamental knowledge about open and closed quantum systems.
- To study the concept of quantum states
- To elaborate the concept of quantum communication over quantum channels.
- To introduce different theorems for representing channel capacities.
- To impart the concept of entanglement and quantum channel capacity.
- To introduce different theorems for quantum state compression.

**UNIT-I (9+3)**

**Quantum mechanics basics:** Hilbert Space, density matrices, projective measurements, pure states and mixed states. Observables and commutivity, Heisenberg uncertainty principle, Quantum state preparation. Open and closed Quantum system Dynamics – Definition, unitary evolution of density matrices, requirements of closed and open system quantum maps, reduced density matrices, partial trace operator, open system measurements and positive operator valued Measurements, stinespring theorem, Kraus Representation theorem for open system quantum evolution.

**UNIT-II (9+3)**

**Quantum Communication Theory:** Transmission of classical information over quantum channels. Classical bits encoded into the Z axis spin projection of an electron, quantum state encoding and decoding

**Quantum Information Theory:** Von Neumann entropy, Holevo’s theorem on mutual information for ensembles of quantum states.

**UNIT-III (9+3)**

**Quantum state Compression:** Compressing ensembles of quantum states, relation of pure state ensemble compression with von Neumann entropy, relationship between mixed state compression and Holevo’s theorem, connections between compression ideas and communication channel capacities.

Holevo-Schumacher-Westmoreland theorem for classical channel capacities of quantum channels, King Ruskai-Swarez-Werner Qubit Channel Representation Theorem, Kraus channel representation, channel capacities and their relation to the von Neumann entropy.

**UNIT-IV (9+3)**

**Entanglement and Quantum Channel Capacity** - entanglement, scaling issues in Hilbert space, notion of channel additivity and the role of entanglement in quantum channel capacity calculations

**Quantum Communication over Quantum Channels** - notion of quantum communication over quantum channels, Shor result on entanglement assisted channel capacities for the transmission of quantum states over quantum channels.

**Text books:**
Course Learning Outcomes:
After completion of the course, the student will be able to

- Understand the basic concepts of quantum states, open and closed system quantum maps.
- Understand the transmission of classical information over quantum channels.
- Understand the quantum state encoding and decoding.
- Find the relation between mixed state and compression.
- Understand the role of entanglement in quantum channel capacity calculations.
Course Learning Objectives:
- To design and simulate a communication system.
- To interpret, analyze, model and process a communication signal.
- To implement different sampling techniques.
- To model non-linearity in the communication system.
- To evaluate different parameters of a communication system using Monte Carlo estimation.

LIST OF EXPERIMENTS

I. MATLAB programs:
1. Up-sampling and Interpolation.
2. Signal-to-aliasing-Noise ratio for a given rectangular pulse shape.
3. Impulse response of a fourth-order Butterworth filter using both block and serial processing.
4. To produce sample functions for different random processes.
5. To generate QPSK signal.
6. PN sequence generator.
7. Uniformly distributed random points using Monte Carlo estimation.
9. MCBPSK - delay, BER.
10. MCQPSK - delay, BER.
11. MCQPSK - phase sync, phase jitter, sym jitter.
12. Baseband non-linearity using general limiter model.

II. Trainer Kit Based Experiments:
Mobile trainer:
1. Study of the Tx IQ/Rx IQ signals
2. Study of the Signal Constellation of GMSK signal
3. Study of the GSM Data rate and Encoded GMSK Signal
4. Constellation of GMSK signal(X-Y)
5. Study of audio signal
6. Study and Measure of PWM signal
7. Observation of PWM signal of Buzzer

Global Positioning System Trainer:
1. Understanding the Shape of Earth
2. Measurement of latitude, longitude

Course Learning Outcomes:
After completion of the course, the student will be able to
- analyze Signal to Noise ratio for a given input.
- understand impulse responses of various types of digital filters.
- implement the PN sequence generator.
- estimate different parameters using Monte Carlo techniques.
- model the non-linearities in communication systems.
PI4DC208 DIGITAL COMMUNICATION LABORATORY

Class: M.Tech. II Semester                                          Branch: Digital Communications

Teaching Scheme:                                               Examination Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Continuous Internal Evaluation: 40 marks
End Semester Exam: 60 marks

Course Learning Objectives:
- To simulate different discrete transform techniques.
- To interpret, analyze, model and process a Huffman coding technique.
- To simulate JPEG image compression.
- To simulate motion vector estimation.
- To generate a video signal using frames.
- To simulate various digital modulation techniques using MATLAB.
- To introduce ELANIX software for implementing various digital modulation techniques.

LIST OF EXPERIMENTS

I. MATLAB programs:

Data Compression Techniques

<table>
<thead>
<tr>
<th>S No.</th>
<th>Name of the Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1-Dimensional Discrete Fourier Transform (1-DFT)</td>
</tr>
<tr>
<td>2.</td>
<td>2-Dimensional Discrete Fourier Transform (2-DFT)</td>
</tr>
<tr>
<td>3.</td>
<td>1-Dimensional Discrete Cosine Transform (1-DCT)</td>
</tr>
<tr>
<td>4.</td>
<td>2-Dimensional Discrete Cosine Transform (2-DCT)</td>
</tr>
<tr>
<td>5.</td>
<td>Huffman Coding Technique</td>
</tr>
<tr>
<td>7.</td>
<td>Motion Vector Estimation</td>
</tr>
<tr>
<td>8.</td>
<td>Video generation Using frames</td>
</tr>
</tbody>
</table>

Data & Computer Communications:

1. Amplitude Shift keying (ASK) using MATLAB
2. Frequency Shift keying (FSK) using MATLAB
3. Phase Shift Keying (PSK) Using MATLAB

II. ELANIX software Experiments:

1. Amplitude Shift keying (ASK) Modulation and Demodulation.
2. Frequency Shift keying (FSK) Modulation and Demodulation.
3. Phase Shift Keying (PSK) Modulation and Demodulation.
4. Quadrature Phase Shift Keying (QPSK) Modulation and Demodulation.

Course Learning Outcomes:

After completion of the course, the student will be able to

- Analyze different discrete transform techniques.
- Understand video signal generation using frames.
- Implement the various digital schemes.
- Understand the various digital modulation and demodulation schemes.
- Analyze different shift keying techniques.
P14DC209 COMPREHENSIVE VIVA-VOCE

Class: M.Tech. II Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 100 marks |
| End Semester Exam:              | -         |

There shall be only external oral examination for Comprehensive Viva-voce on a pre-notified date. The oral examination shall cover the entire content of courses covered in First and Second Semesters.
P14DC301 INDUSTRIAL TRAINING

Class: M.Tech. III Semester  Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Examination Scheme:

| Continuous Internal Evaluation: | 100 marks |
| End Semester Exam:              | -         |

M.Tech. Coordinator in consultation with the Training & Placement Section has to procure training slots, for the students before the last day of instruction of 2nd semester.

The students shall confirm their training slots by the last day of 2nd semester.

The students after 8 weeks Industrial Training shall submit a certificate, a report in the prescribed format before the last date specified by the Department Post Graduate Review Committee (DPGRC). The DPGRC shall evaluate their submitted reports and oral presentations.
P14DC302 DISSERTATION

Class: M.Tech. III Semester

Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
</tbody>
</table>

Examination Scheme:

<table>
<thead>
<tr>
<th>Continuous Internal Evaluation:</th>
<th>100 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Semester Exam:</td>
<td>-</td>
</tr>
</tbody>
</table>

Registration Seminar shall be arranged within four weeks after completion of the Industrial Training and Seminar in the 3rd semester. The Registration Seminar shall include a brief report and presentation focusing the identified topic, literature review, time schedule indicating the main tasks, and expected outcome.

Progress Seminar-I: At the end of first stage (third semester), student shall be required to submit a preliminary report of work done for evaluation to the project coordinator and present the same before the DPGRC. The Continuous Internal Evaluation (CIE) for the third semester is as follows:
P14DC401 DISSERTATION

Class: M.Tech. IV Semester
Branch: Digital Communications

Teaching Scheme:

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

Examination Scheme:

<table>
<thead>
<tr>
<th>Continuous Internal Evaluation:</th>
<th>40 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>End Semester Exam:</td>
<td>60 marks</td>
</tr>
</tbody>
</table>

**Progress Seminar-II** shall be arranged during the 6th week of IV semester.

**Progress Seminar-III** shall be arranged during the 15th week of IV semester.

**Synopsis Seminar** shall be arranged two weeks before the final thesis submission date. The student shall submit a synopsis report covering all the details of the works carried out duly signed by the Dissertation Supervisor.

At the end of second stage (fourth semester), student shall be required to submit two bound copies, one being for the department and other for the Dissertation Supervisor. The Dissertation report shall be evaluated by the DPGRC and external examination shall be conducted on a pre-notified date. The Dissertation evaluation for the fourth semester is as follows: