# Syllabus for Signal Processing & Communication Engineering

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Contact Hours (L-T-P)</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCPC 101</td>
<td>Modern Digital Communication Technique</td>
<td>4-0-0</td>
<td>04</td>
</tr>
<tr>
<td>SCPC 102</td>
<td>Architecture of DSP</td>
<td>4-0-0</td>
<td>04</td>
</tr>
<tr>
<td>ETPC 102</td>
<td>Information theory, Coding &amp; Cryptography</td>
<td>4-0-0</td>
<td>04</td>
</tr>
<tr>
<td>SCPE 103</td>
<td>Digital Image Processing</td>
<td>3-0-0</td>
<td>03</td>
</tr>
<tr>
<td>VLPC 104</td>
<td>Digital Integrated Circuit Design</td>
<td>3-0-0</td>
<td>03</td>
</tr>
<tr>
<td>SCPE 102</td>
<td>VLSI Digital Signal Processing</td>
<td>3-0-0</td>
<td>03</td>
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<tr>
<td>SCPE 101</td>
<td>Digital Filter Design</td>
<td>3-0-0</td>
<td>03</td>
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<tr>
<td>VLPE 104</td>
<td>Analog Integrated Circuit Design</td>
<td>3-0-0</td>
<td>03</td>
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<tr>
<td>ETPE 102</td>
<td>Satellite Communication System</td>
<td>3-0-0</td>
<td>03</td>
</tr>
<tr>
<td>SCPT 101</td>
<td>Seminar - I on Pre Thesis Work</td>
<td>0-0-3</td>
<td>02</td>
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<tbody>
<tr>
<td>VLPC 202</td>
<td>RF and Mixed Signal Integrated Circuit Design</td>
<td>3-0-0</td>
<td>03</td>
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</table>

## Credits (Theory) 18

### Professional Elective-I (any One)
- Telecommunication Switching networks
- Digital Image Processing
- Fibre Optics Components & Devices
- Analog Integrated Circuit Design
- Satellite Communication System

### Professional Elective-II (any One)
- Digital Image Processing
- Fibre Optics Components & Devices
- Analog Integrated Circuit Design
- Satellite Communication System

### Professional Elective-III (any One)
- Statistical Signal Processing
- Adaptive Signal Processing
- Optical Communication
- Pattern Reorganization & Analysis

### Professional Elective-IV (any One)
- Wireless communication
- Neural Network
- LabVIEW Digital Signal Processing
- Mobile Communications

### Professional Elective-VI (any One)
- Signal & Systems Simulation Lab
- Comprehensive Viva
- Technical Seminar

### Credits (Practicals/Sessionals) 06

### Total Semester Credits 24

### Total Cumulative Credits 49

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<tr>
<td>SCPC 301</td>
<td>Thesis Part - I</td>
<td>0-0-3</td>
<td>14</td>
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<tr>
<td>SCPT 401</td>
<td>Thesis Part - II</td>
<td>0-0-6</td>
<td>20</td>
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<tr>
<td>SCCV 402</td>
<td>Technical Seminar</td>
<td>0-0-3</td>
<td>02</td>
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### Credits (Practical/Sessional) 14

### Total Semester Credits 17

### Total Cumulative Credits 49

### Open Electives (any ONE)
- Project Management / Project Costing / Technology Management / Research
- Methodology / Optimization Techniques

### Credits (Theory) 03

### Practical/Sessionals

### Credits (Practicals/Sessionals) 06

### Total Semester Credits 17

### Total Cumulative Credits 49
FIRST SEMESTER

MODERN DIGITAL COMMUNICATION TECHNIQUES

Module 1:

Deterministic & Random Signal Analysis

Module 2:

Digital Modulation Scheme

Optimum Receivers for AWGN Channels
Waveform and Vector Channel Models; Optimum Detection for a General Vector Channel. Waveform and Vector AWGN Channels; Optimal Detection for the Vector AWGN Channel, Implementation of the Optima Receiver for the AWGN Channels. Optimal Detection and Error Probability for ASK, PAM, PSK AND QAM Signaling. [Proakis & Salehi Sections 4.1-1, 4.2-1, 4.2-2, 4.3-1, 4.3-2, 4.3-3]

Carrier and Symbol Synchronization

Module 3:

Digital Communication Through Band-Limited Channels

Multichannel and Multicarrier Systems

Spread Spectrum Signals for Digital Communication

Text Book


Reference Books

1. Simon Haykin, *Digital Communication*, Willy
ARCHITECTURE OF DSP


Text Book

Reference Book

INFORMATION THEORY, CODING AND CRYPTOGRAPHY

Module: 1

Source Coding
Introduction to information theory, uncertainty of information, Information measure, entropy, source coding Theorem, Huffman Coding, runlength encoding, rate distortion function, JPEG and MPEG standards in image compression.

Channel Capacity and Coding
Channel models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit.

Module: 2

Error Control Coding
Linear Block Codes: Introduction, Basic definition, equivalent codes, parity - check matrix, decoding, syndrome decoding, Perfect Codes, Hamming Codes, Optimal Linear codes.

Cyclic Codes
Introduction polynomials, The division Algorithm, Method for generating cyclic codes, Burst Error correction, Fire Codes, Golay Codes, CRC Codes, Circuit implementation.
Bose Chaudhuri-Hocquenghem (BCH)
Introduction, Primitive elements, minimum polynomials, Examples of BCH codes, Decoding of BCH codes, Recd - Solomon codes.

Module: 3

Convolution Codes
Introduction, Tree Codes and Trellis Codes, Polynomial description, The Generating function, Matrix Description, Viterbi Decoding, Distance bounds, Turbo Codes, Turbo Decoding.

Trellis Coded Modulation (TCM)
Introduction, the concept of coded modulation, Mapping by set Partitioning, Design rules, TCM Decoder.

Coding for Secure Communication, Cryptography
Introduction, encryption techniques, Symmetric cryptography, data encryption standard, Asymmetric Algorithm the RSA Algorithm.

Textbooks:

Recommended Reading:

TELECOMMUNICATION SWITCHING & NETWORKS

MODULE – I
Introduction
Evolution, simple telephone communication, basis of switching system, telecommunication networks.

Electronic space division switching
Stored program control, centralized and distributed SPC, software architecture, application software, enhanced software, two and three stage networks.

Time Division Switching
Basic time division space switching, basic time division time switching, timemultiplexed space and time switching, combination switching, three-stage combination switching.

MODULE – II
Traffic Engineering
Network traffic load and parameters, Grade of service, modelling switchingsystems, incoming traffic, blocking models and loss estimates.

Telephone Networks
Subscriber loop systems, switching hierarchy and routing, transmission plan, transmission systems, signalling techniques.

MODULE – III
Data Networks
Data transmission in PSTN, switching techniques, Data communication architecture, link-to-link layers, end-to-end layers, satellite based datanetworks, LAN, MAN, Fibre optic networks, an overview of data network standards. Integrated Service Digital Network, motivation, new services, transmission channels, signalling, service characterization, ISDN standards, broad band ISDN, voice data integration.

Textbooks:
DIGITAL FILTER DESIGN


Textbooks

Reference books

DIGITAL INTEGRATED CIRCUIT DESIGN

MODULE – I
Introduction, Design Metrics and Manufacturing Process:

The Devices:

The CMOS Inverters and CMOS Logic Gates – the Static View:
Introduction to CMOS Inverter, The Static CMOS Inverter – An Intuitive Perspective, Evaluating the Robustness of the CMOS Inverter, Introduction to Static CMOS Design, Complementary CMOS, Ratioed Logic, Pass-Transistor Logic

CMOS Inverter – the Dynamic View:

MODULE – II
Dynamic CMOS Logic, Timing Metrics:
Dynamic CMOS Design, CMOS Logic Design Perspectives, Timing Metrics: Timing Metrics for Sequential Circuits, Classification of Memory Elements

Static and Dynamic Sequential Circuits:
Static Latches and Registers, Dynamic Latches and Registers, Alternative Register Styles: Pulse Registers and Sense-Amplifier Based Registers, Pipelining: An Approach to Optimize Sequential Circuits – Latch Vs Register-Based Pipelines and NORA-CMOS – A Logic Style for Pipelined Structures, Nonbistable Sequential Circuits

Coping with Interconnect:
Introduction, Capacitive Parasitics, Resistive Parasitics, Inductive Parasitics, Advanced Interconnect Techniques, Networks-on-a-Chip

Timing Issues in Digital Circuits:

MODULE – III
Designing Arithmetic Building Blocks:
Designing Memory and Array Structures:
Introduction, The Memory Core, Memory Peripheral Circuitry, Memory Reliability and Yield, Power Dissipation in Memories, Case Studies in Memory Design: The PLA, A 4-Mbit SRAM and A 1-Gbit NAND Flash memory, Perspective: Semiconductor Memory Trends and Evolution

Validation and Test of Manufactured Circuits:
Introduction, Test Procedure, Design for Testability, Test Pattern Generation

Textbooks:

Recommended Reading:

VLSI DIGITAL SIGNAL PROCESSING SYSTEMS

MODULE – I
Introduction to DSP System: Typical DSP algorithms, DSP application demands and scaled CMOS technology, Representation of DSP algorithms.

Iteration Bound: Data-flow graph representations, Loop bound and iteration bound, Algorithms for computing iteration bound, Iteration bound of multirate data-flow graphs.

Pipelining and Parallel Processing: Pipelining of FIR digital filters, Parallel processing, Pipelining and parallel processing for low power.

Retiming: Definitions and properties, Solving systems of inequalities, Retiming techniques.

MODULE – II
Unfolding: An algorithm for unfolding, Properties of unfolding, Critical path, unfolding and retiming, Applications of unfolding.

Folding: Folding transformation, Register minimization techniques, Register minimization in folding architectures, Folding of multirate systems.

Systolic Architecture Design: Systolic array design methodology, FIR systolic arrays, Selection of scheduling vector, Matrix-matrix multiplication and 2D systolic array design, Systolic design for space representations containing delays.

MODULE – III
Bit-Level Arithmetic Architecture: Parallel multipliers, Interleaved floor-plan and bit-plane-based digital filters, Bit-serial multipliers, Bit-serial filter design and implementation, Canonic signed digit arithmetic, Distributed arithmetic.


Textbooks:

Recommended Reading:
**DIGITAL IMAGE PROCESSING**


**Text Book**

**Reference Book**

**FIBRE-OPTIC COMPONENTS AND DEVICES**

**MODULE – I**
**Fibre-Optic Light Sources and Detectors**
Brief description on the principle of optical detectors, photodetector noise, Noise sources, Signal-to-Noise ratio, Detector response time, Depletion layer photocurrent, Response time, Avalanche multiplication noise.

**MODULE – II**
**Optical Fibre Connection**
Joint loss, Multi mode fibre joints, Singe mode fibre joints, Fibre splices, Fusion splices, Mechanical splices, Multiple splices, Fibre connectors, Cylindrical ferrule connectors, Biconical ferrule connectors, Double eccentric connectors, Duplex fibre connectors, Expanded beam connectors, Fibre couplers, Three port couplers, Four port couplers, Star couplers, WDM couplers.

**MODULE – III**
**Optical Amplification and Integrated Optics**

**Textbooks:**
2. J.M. Senior, *Optical Fibre Communications Principles and Practice*, PHI.

**ANALOGUE INTEGRATED CIRCUIT DESIGN**

**MODULE – I**
**Introduction:**
The MOS Transistor, I-V Characteristics, Equivalent Circuits, Noise

**Resistor, Capacitors and Switches:**
Integrated Resistors, Integrated Capacitors, Analog Switches, Layout of Switches

**Basic Building Blocks:**
Inverter with Active Load, Cascode, Cascode with Cascode Load, Source Follower, Threshold Independent Level Shift, Improved Output Stages

**MODULE – II**

**Current and Voltage Sources:**
Current Mirrors, Current References, Voltage Biasing, Voltage References

**CMOS Operational Amplifiers:**
General Issues, Performance Characteristics, Basic Architecture, Two Stages Amplifier, Frequency Response and Compensation, Slew Rate

**MODULE – III**

**Operational Amplifiers and OTAs**
Design of Two Stage OTAs: Guidelines, Single Stage Schemes, Class AB Amplifiers, Fully Differential Op-Amps, Micro-Power OTAs, Noise Analysis, Layout

**CMOS Comparators:**
Performance Characteristics, General Design Issues, Offset Compensation, Latches

**Textbooks:**

**Reference Books:**

**SATELLITE COMMUNICATION SYSTEM**

**Module: 1**
**Satellite Communication Technology**
Satellite orbits, Satellite constellation and ISL, orbital parameters, look angle determination, launching procedures. Spacecraft subsystems - Attitude and orbit control, power, TT & C, communication and antennas. Earth station design - Digital transmitter and receiver, antenna and beam steering techniques.

**Module: 2**
**Link Design**
Digital satellite link analysis and design for FSS and BSS - link budget and Eb/No calculations, Performance impairments - Noise, interference, propagation effects and frequency considerations.

**Module: 3**
**Access Techniques**
FDMA concept- Intermodulation and back off - SPADE system. TDMA concept - Frame and burst structure - Frame acquisition and synchronization - Satellite Switched TDMA system. CDMA concepts - DS and FH System acquisition and Tracking. Audio broadcasting via satellite – World Space Services through Teledesic, LEO system and Globstar.

**Textbooks:**

**Recommended Reading:**
SECOND SEMESTER

DIGITAL IMAGE & VIDEO PROCESSING

Module I (12 Hrs)


Module II (14 Hrs)
Image Segmentation: Pixel classification, Bi-level thresholding, Multi-level thresholding, P-tile method, Adaptive thresholding, Spectral & spatial classification, Edge detection, Hough transform, Region growing.


Module III: (10 Hrs)
Video Processing: Representation of Digital Video, Spatio-temporal sampling; Motion Estimation; Video Filtering; Video Compression, Video coding standards.

Texts/References

DETECTION AND ESTIMATION THEORY

Module 1: Fundamentals of Detection Theory
Hypothesis Testing: Bayes” Detection, MAP Detection, ML Detection, Minimum Probability of Error Criterion, Min-Max Criterion, Neyman-Pearson Criterion, Multiple
Hypothesis, Composite Hypothesis Testing: Generalized likelihood ratio test (GLRT), Receiver Operating Characteristic Curves.

Module 2: Fundamentals of Estimation Theory

Module 3: Estimation Techniques
Random Parameter Estimation: Bayesian Philosophy, Selection of a Prior PDF, Bayesian linear model, Minimum Mean Square Error Estimator, Maximum a Posteriori Estimation
State Estimation: Prediction, Single and Multistage Predictors, Filtering, TheKalman Filter
References:

STATISTICAL SIGNAL PROCESSING

Module I


Module II


Module III

Text Book

Reference Books

ADAPTIVE SIGNAL PROCESSING

MODULE – I

Adaptive System
Definition and Characteristics, Areas of Application, Example of an Adaptive System, Adaptive Linear Combiner, The Performance Function, Gradient and Minimum Mean-Square Error, Alternative Expression of the Gradient, Decorrelation of Error and Input Components. [Read Widrow: Chapter 1 and 2]
Winer Filter
Linear Optimum Filtering, Principle of Orthogonality, Minimum Mean Square Error, Winer-Hopf Equation, Error Performance Surface. [Read Haykin: Chapter 2.1-2.5]

Linear Prediction
Forward Linear Prediction, Backward Linear Prediction, Properties of Prediction Error Filters. [Read Haykin: Chapter 3.1, 3.2, 3.4]

MODULE – II
Method of Steepest Descent
Basic Idea of Steepest-Descent Algorithm, Steepest-Descent Algorithm Applied to Winer Filter, Stability of Steepest-Descent Algorithm, Limitations of Steepest-Descent Algorithm. [Read Haykin: Chapter 4.1 – 4.3, 4.6]

Least-Mean Square Adaptive Filter
Overview, LMS Adaptation Algorithm, Application, Comparison of LMS With Steepest-Descent Algorithm. [Read Haykin: Chapter 5.1 – 5.3, 5.5]

Normalized Least-Mean Square Adaptive Filter
Normalized LMS Filter as the Solution to Constrained Optimization Problem, Stability of the NLMS. [Read Haykin: Chapter 6.1, 6.2]

MODULE – III
Frequency-Domain and Subband Adaptive Filters
Block Adaptive Filters [Read Haykin: Chapter 7.1]

RLS Adaptive Filters
Statement of Linear Least-Square Estimation Problem, Matrix Inversion Lemma, The Exponentially Weighted RLS Algorithm. [Read Haykin: Chapter 8.1,9.1 – 9.3]

Kalman Filter
Recursive Minimum Mean-Square Estimation For Scalar Random Variable, Kalman Filtering Problem, Initial Conditions, Summary of Kalman Filter. [Read Haykin: Chapter 10.1, 10.2, 10.6, 10.7]

Textbooks:

RADAR AND SONAR SIGNAL PROCESSING

Module I: Introduction to Radar Systems
Introduction: History and applications of radar, basic radar functions, elements of pulsed radar, review of selected signal processing concepts and operations. A preview of basic radar signal processing.
Signal Models: Components of a radar signal, amplitude models, clutter, noise model and signal to noise ratio, jamming, frequency models, spatial models, spectral model.
Sampling and Quantization of Pulsed Radar Signals: Domains and criteria for sampling radar signals.
Sampling in the fast time domain, sampling in slow time domain, sampling the Doppler spectrum.
Sampling in the spatial and angle dimensions, quantization.

Module II: Doppler Processing & Detection
Alternate forms of Doppler spectrum, Moving Target Indication (MIT), pulse Doppler processing, pulse pair processing, clutter mapping and the moving target detector.
Radar detection as hypothesis testing, Threshold detection in coherent systems, Threshold detection of radar signals, binary integration.

Module III: Overview of sonar systems
Sonar Basics: Propagation of sound in the ocean, noise in the ocean.
Analysis of Sonar Signals: The sonar equation, signal/noise considerations, Generation of underwater sound, Nonlinear effect of depth

Detection of Sonar signals: Threshold concept, Various types of detector, Typical problems in detection of sonar signals, Adaptive digital filters, Digital Doppler nullification

Text Books:

Reference Books:

BIOMEDICAL INSTRUMENTATION AND SIGNAL PROCESSING

MODULE – I

Introduction: Cell structure, basic cell function, origin of bio-potentials, electric activity of cells.

Biotransducers: Physiological parameters and suitable transducers for its measurements, operating principles and specifications for the transducers to measure parameters like blood flow, blood pressure, electrode sensor, temperature, displacement transducers.

MODULE – II

Cardiovascular system: Heart structure, cardiac cycle, ECG (electrocardiogram) theory (B.D.), PCG (phonocardiogram). EEG, X-Ray, Sonography, CT-Scan. The nature of biomedical signals.

Analog signal processing of Biosignals: Amplifiers, Transient Protection, Interference Reduction, Movement Artifact Circuits, Active filters, Rate Measurement. Averaging and Integrator Circuits, Transient Protection circuits.

MODULE – III

Time-frequency representations: Introduction, Short-time Fourier transform, spectrogram, wavelet signal decomposition.

Biomedical applications: Fourier, Laplace and z-transforms, autocorrelation, crosscorrelation, power spectral density.

Noise: Different sources of noise, Noise removal and signal compensation.

Software based medical signal detection and pattern recognition.

TextBooks:

References
1. Wills J. Tompkins, Biomedical Digital Signal Processing, PHI.
3. Cromwell, Biomedical Instrumentation and Measurements, 2nd Edn, Pearson Education.
WIRELESS COMMUNICATION

Module – I


Small Scale Propagation: small scale multi path propagation. Small scale multi path measurements, Parameters of multi path channels, types of multi path fading, Rayleigh and Ricean distribution, Clarke’s model, multi path space factors, fading rate variance.

Module – II

Module – III
Evolution of Modern Mobile Wireless Communication systems
WPAN, IEEE 802.15, DECT, PACS, brief survey of: 1G wireless networks, 2G wireless cellular networks, GSM (radio subsystem, operation subsystem), GSM multiple access scheme, GSM channel organization, call setup procedure, 2.5G networks, GPRS network architecture, classes of GPRS equipments. IS-95 systems, 3G (UMTS) (without details) of network architecture.


A brief overview of WiMAX technology (broadband wireless communication).

TEXT BOOKS:

REFERENCE BOOKS:
3. Wireless Digital Communication by KamiloFeher, PHI.
5. Introduction to CDMA Wireless Communication by Mosaali Abu Rgheff, Elsevier.

OPTICAL COMMUNICATION

Module – I
Evolution of Fibre Optic systems, Elements of an optical Fibre transmission link, Basic optical laws and definitions, Optical fibre modes and configurations, Rays and modes, Ray optics representation, Wave representation, mode theory for circular wave guides, wave guide equations, wave equation for step index

Module – II
Signal degradation in Optical fibres, Attenuation, Absorption, scattering losses, bending loses core and cladding losses. Signal distortion in optical wave guides, information capacity of optical fibres, Material dispersion, wave guide dispersion, signal distortion in single mode fibres, Inter modal distortion. Pulse broadening in graded index fibre guides, Design optimization of single-mode fibres (elementary concepts)
Basic ideas of light sources and their principle of operation (LEDs and LASERS), power-bandwidth product of LEDs and modulation capability, resonant frequencies of LASER diodes, Physical principles of photo detectors, Avalanche photo diodes
Optical receiver operation (Fundamentals) digital signal transmission, error sources, Digital transmission systems, link power budget, Rise time budget Transmission distance for single mode links, first window transmission distance, Line codes used computer aided modeling of an optical fibre link; Receiver noises.

Module – III
Coherent Optical fibre communications, definition and classification of coherent system, fundamental concepts; Homodyne detection, heterodyne detection, source line widths, wavelength tuning, modulation techniques. Direct-detection OOK, OOK homodyne system, PSK homodyne system, heterodyne detection schemes. Performance improvement with coding. Polarization control requirements.
Wave length division multiplexing optical fibre ring as LAN, FDDI.Optical amplifiers; type of amplifiers with expression for gains and noise figure, optical bandwidth, Photonic switching integrated optical switches.

TEXT BOOK

REFERENCE BOOK

PATTERN RECOGNITION AND ANALYSIS

Module 1:

Module II:

Module III:
References

RF AND MIXED SIGNAL INTEGRATED CIRCUIT

MODULE – I
Introduction: Overview of wireless principles, Characteristics of passive IC components – resistors, Capacitors, Inductors, Transformers, Interconnect at RF and high frequencies, Skin effect.
Bandwidth Estimation Techniques: Method of open-circuit time constants, Method of short-circuit time constants, Rise time, Delay and Bandwidth.
High-frequency Amplifier Design: Zeros as bandwidth enhancers, Shunt-series amplifier, Bandwidth enhancement with ft doubling, Tuned amplifiers, Neutralization and unilaterization, Cascaded amplifiers, AM-PM conversion.

MODULE – II
Voltage Reference: Review of diode behavior, Diodes and Bipolar Transistors in CMOS technology, Supply-independent bias circuits, Bandgap voltage reference, Constant-gm bias.

MODULE – III
Mixers: Mixer fundamentals, Non-linear systems as linear mixers, Multiplier-based mixers, Sub-sampling mixers, Diode-ring mixers.
RF Power Amplifiers: Classes of power amplifiers, RF power amplifier design example, Power amplifier characteristics and Design consideration. Phase-Locked Loops (PLL): Introduction to PLL, Linearized PLL models, Some noise properties of PLLs, Phase detectors, Sequential phase detectors, Loop filters and charge pumps, PLL design examples.
Oscillators and Synthesizers: Problems with purely linear oscillators, Describing functions, Resonators, Tuned oscillators, Negative resistance oscillators, Frequency synthesis.

Textbooks:

Recommended Reading:

NEURAL NETWORK

Module I:

Module II:

Module III:

References:
3. Kumar S, Neural Networks : A Classroom Approach, TMH
5. Yegna Narayana B – Artificial Neural Networks – PHI
6. Timothy J Ross – Fuzzy logic with Engineering Applications
7. Christopher Bishop, Neural Networks for Pattern Recognition, Oxford University Press
8. J M Zurada, Introduction to Artificial Neural Networks, Jaico Publishing House

LABVIEW DIGITAL SIGNAL PROCESSING

Module I:
Digital Communications and LabVIEW: Conventional Digital Receiver, Subsampling Receiver
Getting a Signal into LabVIEW: Conventional Digital Receiver, Subsampling Digital Receiver, Choosing a sample rate, Subsampling SNR, Subsampling signal placement, the Sampling Methods, Digital oscilloscope, RF spectrum analyzer, Analog sampling card, Soundcard

Module II: Building Blocks
Spectral Analysis: Low-Level Frequency Domain Functions, Simple FFT, Improved FFT, Analyzing the DFT Results, Spectral leakage, Sampling window shape, High-Level Spectral Functions, Adding C Routines to LabVIEW, Spectral Measurements Toolset
Digital Filters: Filter Types, FIR Filters, FIR filter design by windowing, Equiripple FIR filters, IIR Filters, Comparing IIR and FIR Filters, IIR versus FIR magnitude, Effects of filter-phase response, Pulse-Shaping Filter
Multirate Signal Processing in LabVIEW: Upsampling, Downsampling, Resampling Filters, Halfband filters, Polyphase filters
Generating Signals with LabVIEW: Basic Functions, Sinusoids, Complex mixer, Sinc function, Chirp sequence, Generating Channel Models, Rayleigh fading, White gaussian noise, Generating Symbols

Module III: Building a Communication System
Assembling the Pieces: Modulator, Demodulator, Channel Impairments, Signal Detection and Recovery, Matched filter detection, Threshold decisions
Synchronization: Time synchronization, Frequency synchronization, NI Modulation Toolset
System Performance: Performance Measurements, Bit-error rate, Error vector magnitude, Improving System Performance, Channel estimation, Channel coding, Viterbi decoder
Optimizing LabVIEW Signal Processing: General LabVIEW Coding Guidelines, Signal Processing Tips, Linear convolution with the FFT, Fast real FFT
More LabVIEW DSP Applications, Roots of difference equations, Linear predictive speech coder

Text book

LabVIEW Signal Processing Course Manual

Recommended Reading:

MOBILE COMMUNICATIONS


Text Book

Reference Book
2. G. Stuber; Principles of Mobile Communication, 2001, Springer

ADVANCED TECHNIQUES IN DSP

Multi-rate Digital Signal Processing: Decimation by a factor D, interpolation by a factor 1, sampling rate conversion by a national factor i/D; Sampling rate conversion of band pass signals; Implementation of low pass filter and digital filter banks; lattice filters, Linear prediction, forward and backward linear prediction, FIR wiener filter; Power spectrum estimation, non-parametric method Barlett, Parametric method; Yule-Walker MA and ARMA models. Higher order statistics and its applications; DSP transforms: Discrete Hartely transform, Discretecosine transform, Discrete Wavelet transform, S-transform. DSP techniques for bioinformatics, recent topics

Text Book

Reference Book