NAGARJUNA UNIVERSITY
FACULTY OF ENGINEERING
ELECTRONICS AND COMMUNICATION ENGINEERING
Curriculum, Scheme of Examination and Syllabi
For M.Tech Degree Program
In

COMMUNICATIONS AND SIGNAL PROCESSING

Being Offered at

BAPATLA ENGINEERING COLLEGE

FIRST SEMESTER

S. NO	Subject	Scheme of Instruction periods per week		Scheme of Examination			Total
		Theory	Practicals	Duration of University Exam (hrs)	Sessional Marks	University Marks	
1	CSP 511 ADVANCED DIGITAL COMMUNICATION	4	-	3	30	70	100
2	CSP 512 FIBRE OPTIC COMMUNICATION	4	-	3	30	70	100
3	CSP 513 TRANSFORMATION TECHNIQUES	4	-	3	30	70	100
4	CSP 514 ADVANCED DIGITAL SIGNAL PROCESSING	4	-	3	30	70	100
5	CSP 515 DIGITAL IMAGE PROCESSING	4	-	3	30	70	100
6	CSP 516 ELECTIVE - 1	4	-	3	30	70	100
7	CSP 551 COMMUNICATION LAB	-	6	3	25	50	75
		24	6		205	470	675

ELECTIVE I :

CSP 516/1 :ARTIFICIAL NEURAL NEWORKS
CSP 516/2 :ADAPTIVE SIGNAL PROCESSING
CSP 516/3 :MICROWAVE MEASUREMENTS

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SECOND SEMESTER

S. NO	Subject	Scheme of Instruction periods per week		Scheme of Examination			Total
		Theory	Practicals	Duration of University Exam (hrs)	Sessional Marks	University Marks	
1	CSP 521 MOBILE COMMUNICATION	4	-	3	30	70	100
2	CSP 522 SATELLITE COMMUNICATION	4	-	3	30	70	100
3	CSP 523 REAL TIME SIGNAL PROCESSING	4	-	3	30	70	100
4	CSP 524 SPEECH PROCESSING	4	-	3	30	70	100
5	CSP 525 RANDOM PROCESS & INFORMATION THEORY	4	-	3	30	70	100
6	CSP 526 ELECTIVE – II	4	-	3	30	70	100
7	CSP 561 DSP LAB	-	6	3	25	50	75
		24	6		205	470	675

ELECTIVE II :

CSP 526/1 :CODING THEORY & TECHNIQUES
CSP 526/2 :PATTERN RECOGNITION
CSP 526/3 :RADAR SIGNAL PROCESSING

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THIRD SEMESTER

S.NO	SUBJECT TITLE	EVALUATION (INTERNAL)
01.	CSP 651 PROJECT	100 MARKS
02.	CSP 652 SEMINAR	75 MARKS

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FOURTH SEMESTER

S.NO	SUBJECT TITLE	EVALUATION
01.	CSP 661 PROJECT & VIVA VOCE	100 MARKS(INTERNAL) 200 MARKS(EXTERNAL)

NOTE: Project Work starts at the beginning of the Third Semester. The Progress in the project is evaluated at the end of the Third and Fourth Semesters by the Department.

CSP 511 ADVANCED DIGITAL COMMUNICATION

UNIT I

Intersymbol interference, Duo-binary signaling and modified duo-binary signaling, linear predictive coding, review of orthogonal signals, coherent BPSK & BFSK, MSK, Noncoherent modulator techniques, M-ary modulation of PSK, FSK and QAM

UNIT II

PN sequences, A Notion of spread spectrum, Direct – Sequence spread coherent BPSK, signal – space dimensionality and processing gain, probability of error, frequency – hop spread spectrum, synchronization of spread spectrum signals : Acquisition and tracking

UNIT III

Encryption and Decryption: A model of the encryption and decryption process. Cipher systems, stream encryption and Public key encrypto system.

UNIT IV

Fading: Characterization of fading multi-path channels, Diversity Techniques for fading multi-path channels, frequency selective, non-selective fading, Signal time spreading, Time variance of the channel caused by motion.

Text Books:

1. Simon Haykin – Digital Communications
2. B.Sklar, Digital Communications, Addison Wesley.

Reference Books:

1. J.G. Proakis, Digital Communications, McGraw Hill.
2. Taub and Schiling – Principles of Communication Systems 2nd edition

CSP 512 FIBER OPTIC COMMUNICATION

UNIT – I

OPTICAL FIBER WAVEGUIDES

Ray Theory of Transmission, Electro-magnetic Theory for Optical propagation, Cylindrical Fiber, Single-Mode Fibers, Material Absorption Losses in Silica Glass Fiber, Linear Scattering Losses, Non-Linear Scattering Losses, Fiber Bend Loss. Intra modal Dispersion, Inter modal Dispersion, Overall Fiber Dispersion·

UNIT - II

OPTICAL SOURCES

Semiconductor injection Laser, Single Frequency Injection Laser, Non-Semiconductor Lasers, LED Structures, LED Characteristics.

OPTICAL DETECTORS

Semiconductor photo-Diodes without Internal Gain, Semiconductor Photo-Diodes with Internal Gain, Photo-Conductive Detectors, Receiver Noise, Receiver Structures, FET Pre-Amplifiers, Semiconductor Laser Amplifiers, Fiber Amplifiers.

UNIT – III

OPTICAL FIBER SYSTEMS

The Optical Transmitter Circuit, The Optical Receiver Circuit, Digital System Planning Considerations, Analog Systems, Distribution Systems, Advanced Multiplexing Strategies, Detection Principles, Modulation Formats, Demodulation Schemes, Receiver Sensitivities.

UNIT – IV

ADVANCED OPTICAL SYSTEMS

Fiber Optic Lans, FDDI, SONET, Features Concepts, Protocol Architecture and Functional Working Solution Communication System.

Text Books

1. Senior MJ Optical Fiber Communication PHI.
2. Keiser G, Optical Fiber Communication McGraw Hill
3. Shimada Setal Coherent Lightwave Communication Technology, Chappman &Hall.
4. Ghatak AK & Thyagarajan K, Optical Electronics, Foundation Books

CSP 513 TRANSORMATION TECHNIQUES

UNIT – I
Review of FT, LT & ZT properties.

UNIT – II
Short-Time-Fourier Transforms, Properties of STFT, Continuous Wavelet Transforms (CWT), Inverse CWT
Introduction to the Discrete Wavelet Transforms

UNIT – III
ORTHOGONAL WAVELET SYSTEMS:
Designing Orthogonal wavelet systems – refinement relation for orthogonal wave let system, restrictions on filter coefficients , designing daubechies orthogonal wavelet system coefficient, designing coiflet wavelets.
Biorthogonal wavelets- Biorthogonality in vector space, biorthogonal wavelet system , signal representation using biorthogonal wavelet systems , biorthogonal analysis, construction of biorthogonal wavelet systems .

UNIT- IV
Multi-Resolution Analysis (MRA), Two Scale Relations, Orthonormal Wavelets, their Relationship to Filter Banks, PR QMF Filter Banks

Text Books :

1. Signal Processing and Linear Systems, B.P. Lathi, Berkley Cambridge
2. Wavelet Transforms – Introduction to Theory and Applications, Raghuveer M. Rao, Ahit S.Bopardikar, Pearson Education, Asia
3. Insight into wavelets , K.P.Soman, K.I.Ramachandran

References :

1. Signals and Systems, B.P. Lathi
2. Fundaments of Wavelets – Theory, Algorithms and Applications, Jaideva C. Goswami, Andrew K. Chan, John Wiley & Sons

CSP 514 ADVANCED DIGITAL SIGNAL PROCESSING

UNIT - I

MULTIRATE SIGNAL PROCESSING

Introduction, sampling an signal reconstruction, sampling Rate Conversion, Decimation by an Integer Factor, Interpolation by an Integer Factor, Sampling Rate Conversion by a Rational Factor, Sampling Rate Converter as a Time Variant system, Practical Systems for Decimators and Interpolators, Direct Form and Poly-Phase FIR Structures with Time varying Coefficients.

UNIT - II

MULTRATE FIR FILTER DESIGN

Design of FIR Filters for Sampling Rate Conversion, Multistage Implementation of Sampling Rate Conversion, Applications of Interpolation and Decimation in Signal Processing Operations, Low-Pass and Band-Pass Filters, Filter Bank implementation, Sub-Band Processing, Decimated Filter Banks, Two Channel Filter Banks, Tree structured Filter Banks, Octave-Band Filter Banks, Uniform DFT Filter Banks.

UNIT - III

POWER SPECIRAL ESTIMATION

Estimation of Spectra from Finite Duration Observations of a Signal, the Period gram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Turkey methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods.

UNIT - IV

PARAMETRIC METHOD OF POWER SPECTRUM ESTIMATION

Parametric Methods for power spectrum estimation, Relationship between Auto - Correlation and Model Parameters, AR(Auto-Regressive) Process and Linear prediction, Yule-Walker, Burg and Unconstructrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Method, MUSIC Method.

Text Books

1. ProakisJG and Manolakis DG Digital Signal Processing Principles, Algorithms and applications, PHI
2. Openheim AV & Schafer RW, Discrete Time Signal Processing PHI.
3. Orfanadis S, Introduction to Digital Signal Processing PHI
4. Orfanadis S Optimum Signal Processing PHI

CSP 515 DIGITAL IMAGE PROCESSING

UNIT - I

DIGITAL IMAGE FUNDAMENTALS

Elements of Digital Image Processing System, Structure of the Human Eye, Image Formation in the Eye and Contrast Sensitivity, Sampling and quantization of an Image, Base Relationship between Pixels, Imaging Geometry photographic Film.

IMAGE TRANFORMS

Need for Image Transforms. The Discrete Fourier Transforms, Prosperities of DFT, The FFT. Discrete Cosine Transform. Walsh Transform, Hadmard Transform, Hoteling Transform.

UNIT - II

IMAGE ENHANCEMENT & RESTORATION

Spatial Domain Methods Frequency Domain Methods, Histogram Modification Technique, Neighborhood averaging, Median Filtering, Low pass Filtering, Averaging of Images, Image sharpening by Differentiation, High pass Filtering, Degradation Model for Continuous Functions, Discrete Formulation, Digitalization of Circulate and Block - Circulant Matrices, Effects of Digitalization, Constrained and Unconstrained Restorations, Inverse Filtering, Wiener Filter, Constrained Least Square Restoration.

UNIT – III

IMAGE ENCODING

Objective and Subjective Fidelity Criteria, the Encoding process, the Mapping, the Quantizer and the Coder, Contour Encoding, Run Length Encoding, Image Encoding relative to a Fidelity Criterion, Differential Pulse Code Modulation, Transform Encoding.

UNIT - IV

IMAGE SEGMENTATION AND REPRESENTATION

The Detection of Discontinuities, Point Line and Edge Detections, Gradient Operators, Combined Detection, Thresholding, Representation Schemes, Chain Codes, Polygon Approximation, Boundary Descriptors, Simple Descriptors, Shape Numbers, Fourier Descriptors.

Text Books

1. Gonzalez RC & Woods RE., Digital Image Processing, Addison Wesley Publishing Company
2. Rosefeld & Kak AC, Digital Picture Processing Academic press Inc
3. Jain AK, Fundamentals of Digital Image Processing, PHI

CSP 516/1 ARTIFICIAL NEURAL NETWORKS

UNIT – I

Introduction: History of Neural Networks, Structure and functions of biological and artificial neuron, Neural network architectures, Learning methods, evaluation of neural networks

UNIT – II

Supervised learning – I: Single layer networks, McCulloch – Plus Neuron, Model Perceptron I carning, Delta learning Widrow – Hoff learning rules, linear seperability, Adaline and modifications

UNIT – III

Supervised learning – II: Multi layer networks: Architectures, Madalines, Backpropagation algorithm, importance of learning parameter and momentum term, radial basis functions, polynomial networks

Unsupervised learning: Winner – Take – all learning, out star learning, learning vector quantizers, counter propagation networks, Kohonen self-organizing networks, Grossberg layer, adaptive resonance theory, Hamming Net

UNIT – IV

Assoctative memories: Hebbian learning rule, continuous and discrete, Hopfield networks, recurrent and associative memory, Boltzman machines, Bi-directional associative memory Applications of neural networks : Optimization, Travelling Salesman, Problem solving simultaneous linear equations, Applications in pattern recognition and Image Processing

Text Books

1. J.M. Zurada Introduction to Artificial Neural Systems, Jaico Publications
2. Kishan Mehrotra, Chelkuri K. Mohan, Sanjav Ranka, elements of Artificial Neural Networks, Tenram International
3. B. Yegnanarayana, Artificial Neural Networks, PHI, New Delhi
4. Waserman: Neural Computing – Theory and Practice

CSP 516/2 ADAPTIVE SIGNAL PROCESSING

UNIT – I

Adaptive Systems :Definitions,Characteristics, Applications, Example of an Adaptive System.

The Adaptive Linear Combiner: Description, Weight Vectors, Desired Responses, Performance Function, Gradient and Mean-Suare Error.

UNIT – II

Approaches to the Development of Adaptive Filter Theory: Introduction to Filtering Smoothing and Prediction-Linear Optimum Filtering ,Problem Statement . Principle of Orthogonality , Minimum – Mcan- Squared Error, Winer –Hopf Equations, Error Performance , Normal Equation .

UNIT – III

Searching the Performance Surface – Methods and Ideas of Gradient Search Methods, Gradient Searching Algorithm and its Solution, Stability and Rate of Convergence, Learning Curves, Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves

LMS Algorithms – Overview, LMS Adaptation Algorithms, Stability and Performance Analysis of LMS Algorithms, LMS Gradient and Stochastic Algorithms, Convergence of LMS Algorithms

UNIT – IV

Applications – Noise Cancelling, Cancelling Echoes in Long Distance Telephone Circuits, Adaptive Beam Forming

Kalman Filtering Theory – Introduction, Recursive Mean Square Estimation for Scalar Random Variables, Statement of Kalman Filtering Problem, Innovation Process. Estimation of State using the Innovation Process, Filtering, Initial Conditions, Summary of Kalman Filters, Variants of the Kalman Filtering the Extend Kalman Filtering, Identification as a Kalman Filtering Problem

Text Books:

1. Bernand Widrow – Advaptive Signal Processing, PH/Pearson Education, Asia
2. Simon Haykins - Adaptive filter Theory , PH

References :

1. Sophocles J. Orfamidis - Optimum Signal Processing – An Introduction, 2nd Edition, McGraw Hill
2. S. Thomas Alexander – Adaptive Signal Processing – Theory and Applications, Springer – Verlag

CSP 516/3 MICROWAVE MEASUREMENTS

UNIT – I

Measurement of wavelength and frequency, Equivalent circuit of the cavity wave meters, Typical wavemeters, Resonant cavities

Methods of Frequency Measurements : Direct measurement, Interpolation method, Additive frequency method

UNIT – II

Measurement of Impedance : Constructional details of slotted section and its limitations, standing wave detector, Techniques in standing wave detector measurements, Measurement of low & high VSWR., Location of voltage minims, Use of Smith chart in impedance measurements, Errors in standing wave detector impedance measurements, Reflectometers

Measurement of Power : Methods of power measurement, Typical barrette elements, thermistor, bolometer bridge circuits, Extending the range of Bolometer devices, Crystal Detector, Dielectric Measurement for Solids

UNIT – III

Measurements on Microwave circuits and components, T and P network, Measurement of scattering coefficients, Graphical determination of scattering coefficients, Coupling and Directivity of directional coupler

UNIT – IV

Measurement of Attenuation : Insertion of Power ratio method, substitutionmethod, scattering coefficient method, Return Loss

Antenna Measurements : Measurement of radiation patterns, Antenna gain measurements, Antenna impedance Measurements, Polarization Measurements

Text Books

1. E.L. Ginzton, Microwave Measurements, Mc Graw Hill
2. Annapurna Das & Sisir K Das, Microwave Engineering, TMH, 2000
3. P. Rizzi, Microwave Engineering Passive Circuits, Prentice Hall, 1987
4. D.M. Pozar, Microwave Engineering, John Wiley, 1998

Reference Books :

1. M.L. Sisodia & GS Raghuvanshi, Basic Microwave Techniques and Laboratory Manual, Wiley Eastern, 1987
2. Dennis Roddy, Microwave Technology, PHI, 1986

CSP-551 COMMUNICATION LAB

List of Experiments

1. Time Division Multiplexing of signals & Framing in the TDM
2. Study of Manchester Coder – Decoder
3. Forming a PC to PC Communication Link using Optical Fiber and RS 232 interface
4. Measurement of various losses in an Optical Fiber
5. Comparative study of EMI in copper and Optical media
6. Study of Optical Time Domain Reflecto meter
7. Measure the Scattering parameters of the devices: Circulator & Hybrid TEE
8. Study of Antenna Radiation Patterns of E-Plane and H-plane radiation patterns of a Pyramadal horns
9. Study of spectrum analyzer
10. Measurement of Q-factor of cavity resonator
11. Study of Cellular communication Systems
12. Study of Satellite communication Receiver

CSP 521 MOBILE COMMUNICATION

UNIT - I

Introduction – Evaluation of Mobile Radio Communication, Mobile Radio Systems around the world, Examples of Wireless Communication Systems: Paging systems, Cordless Telephone Systems, Cellular Telephone Systems

Modern Wireless Communication Systems: Second generation cellular networks, third generation networks, Wireless Local Loop (WLL) LMDS, Wireless Local Area Networks (WLAN), Bluetooth & Personal Area Networks

UNIT – II

The Cellular Concept – System Design Fundamentals : Introduction, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage & Capacity in Cellular Systems

Mobile Radio Propagation: Large-Scale Path Loss: Introduction, Free Space Propagation Model, Relating Power to Electric Field, The Three Basic Propagation Mechanisms, Reflection, Ground Reflection, Diffraction Scattering, Practical Link Budget Design Using Path Loss Models, Outdoor Propagation Models-(Longley_Rice Model & Durkin's Model_ A Case Study), Indoor Propagation Model (Partition Losses (Same Model) & Partition Losses between Floors), Singal Penetration into Buildings, Ray Tracing and Site Specific Modeling

UNIT - III

Mobile Radio Propagation: Small-Scale Fading and Multipath : Small-Scale Multipath Propagation, Impulse Response Model of a Multipath Channel, Small-Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh and Ricean Distributions, Statistical Models for Multipath Fading Channels, Theory of Multipath Shape Factors for Small-Scale Fading Wireless Channels, Examples of Fading Behavior, Second-Order Statistics Using Shape Factors, Applying Shape Factors to Wideband Channels, Revisiting Classical Channel Models with Shape Factors

UNIT – IV

Review of the Modulation Techniques for mobile radio, Review of the Multiple Access techniques for Wireless Communication, Wireless data networking, Wireless Data Services, AMPS, Global System for Mobile(GSM)

Text Books:

1. TS Rappaport, wireless communications: principles and practice, Pearson education 2nd edition.
2. J G Proakis, Digital Communication, McGraw Hill, 1995.
3.. GE Stuber, Priniciples of Mobile Communications, KIuwer academic 1996.

CSP 522 SATELLITE COMMUNICATIONS

UNIT - I

Introduction

Orbital aspects of Satellite Communications - Look Angle and Orbit determinations - Orbital effects in communication system Performance

Space craft subsystems

AOCS, TT& C, Power system, Satellite transponder, spacecraft Antennas

Satellite Link Design

System Noise temperature and 'G/T ratio - Design of downlink, Uplink - Design of satellite links for specified C/N

UNIT - II

Multiple Accesses

FDMA, TDMA, CDMA, Estimating channel requirements- Practical Demand Access systems, Multiple Access With on board processing

Encoding and forward error correction for Digital Satellite links

Error detection and correction capabilities of Linear Block codes, Binary Cyclic codes, performance of Block error correction Codes, Implementation of error Detection on satellite links.

UNIT - III

Earth Station Technology

Earth Station Design, Design of Large Antennas, Tracking, Small earth station Antennas, Equipment for earth station.

Satellite Packet Communications:

Message transmission by FDMA: The M/G/1 Queue, Message transmission by TDMA - Pure ALOHA: Satellite packet switching - slotted ALOHA -Packet Reservation - Tree algorithm.

UNIT - IV

Very small Aperture Terminal Networks

VSAT Technologies - Network Configurations - Multi access and Networking Network Error Control - Polling VSAT Networks.

Mobile Satellite Networks

Operating Environment - MSAT Network concept - CDMA MSAT Network.

Text Books

1. Satellite Communications by T. Pratt and C.W. Bostian.
2. Digital Satellite Communication by Tri T. Ha (2 ed)

Reference:

1. Satellite Communications - by Dr. D.C. Agarwal
2. Electronic Communication Systems -by Tomasi. W

CSP 523 REALTIME SIGNAL PROCESSING

UNIT – 1

Real time concepts, structural levels of processing, Digital Signal Processing and DSP systems, Comparison between general purpose and DSP processors, Examples of digital signal processors, Motivation of the specialized processors.

UNIT – II

Numeric representation and Arithmetic Fixed point vs floating point, native data word width, Relation between data word size and Instruction word size, Effects of finite word registers

UNIT – III

Key features of TMS 320 C54XX, architecture and addressing modes

UNIT – IV

Important Instruction set of TMS 320 C54XX

UNIT – V

Implementation of Digital Filters on DSP Processors – FFT, FIR filters. IIR filters, Adaptive filters and multirate filters

Text Books:

1. John G. Ackenhhusin. Realtime Signal Processing, Prentice Hall of India, 1999
2. Phil Lapsley, Jeff Bier, Amit Sheham, DSP Processor Fundamentals – Architecturs and Features: S. Chand & Co., New Delhi
3. TMS 320C54XX. User's guide

CSP 524 SPEECH PROCESSING

UNIT – I

Introduction – Signal and Linear Systems, Frequency analysis, Discrete-time signals and systems, filters

Speech production and acoustic phonetics – Anotomy and psysiology of speech organs, articulatory phonetics, acoustic phonetics

Short-time speech analysis – windowing, spectra of windows, signal – analysis in time domain, short time energy, magnitude, zero-crossing rate and auto correlation function, Frequency domain analysis – filter banks, formant estimation and tracking

UNIT – II

Linear predictive coading (LPC) analysis – Basic principles, computation of LP coefficients, spectral estimation, window considerations, emphasizing low frequencies, pole-zero LPC models

Cepstral analysis – Mathematical details, applications of the capstrum, Mel-scale capstrum, pitch estimation using time domain and short-time spectral techniques

UNIT – III

Speech enhancement – Nature of interfering sounds, speech enhancement techniques, spectral subtraction, enhancement by resynthesis

Automatic speech recognition – Basic pattern recognition approaches, parametric representation of speech, evaluating the similarity of speech patterns, spectral and temporal variability

UNIT – IV

Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, training and testing using HMMs, adapting to variability in speech, language models

Speaker recognition – Recognition techniques, features that distinguish speakers, system design, language and accent identification

Text books :

1. Douglas O Shaughnessy, Speech Communications, second Edition, Oxford University Press, 2000
2. L.R Rabiner and S.W.Schafer. digital Processing of speech signals, Prentice Hall

References :

1. Owens, Signal Processing of Speech
2. Dellar and Proakis, Digital Signal Processing, PHI

CSP 525 RANDOM PROCESS

UNIT -I

RANDOM VARIABLES

Definition of Random Variable, Probability of Distribution Function, Probability Density Function(PDF), Conditional and Joint Distribution and Densities, Functions of Random Variables, Determining the PDF of Y = g(X), Expected value of a Random Variable, Conditional Expectations, Moments, Joint Moment, Properties of Uncorrelated Random Variables, Jointly Gaussian Random Variables.

UNIT –II

RANDOM PROCESSES

Introduction, Mathematical definition of a Random Process, Stationary Processes, Mean, Correlation, and Covariance Functions, Ergodic Processes, Transmission of a Random Process through a Linear Time-invariant Filter, Power Spectral Density, Gaussian Process, Noise, Narrowband Noise, Representation of Narrowband Noise in terms of In-phase and Quadrature Components, Representation of a Narrowband Noise in terms of Envelope and Phase Components.

UNIT –III

ADVANCED TOPICS IN RANDOM PROCESSES

Mean square (m.s.) calculus, Stochastic Continuity and Derivatives, Further results on m.s. Convergence, m.s. Stochastic Integrals, m.s. Stochastic Differential Equations, Karhunen-Loeve Expansion, Representation of Band limited and Periodic Processes, Band limited processes, Band pass Random Processes.

UNIT –IV

APPLICATION TO STATISTICAL SIGNAL PROCESSING

Estimation of random variables, innovation sequences and Kalman filtering, wiener filters for random sequences, hidden markov models.

Text Books:

1. PROBABILITY AND RANDOM PROCESSES HENRY STARK JOHN W. WOODS, 3"° PEA
2. COMMUNICATION SYSTEMS SIMON HAYKIN, 4TH Ed
3. PROBABILITY AND RANDOM VARIABLES PEBBELS
4. PROBABILITY, RANDOM VARIABLES AND STOCASTIC PROCESSES PAPOOLIS

CSP 526/1 CODING THEORY AND TECHNIQUES

UNIT – I

Source Coding : Mathematical models of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, coding for Discrete memoryless Sources, Properties of Codes, Iluffman Code, Run Length Codes, Lempel-Ziv Codes, Shanon – Fano coding

UNIT – II

Channel Coding : Introduction to Linear Block Codes, Generated Matrix, Systematic Linear Block Codes, Encoder Implementation of Linear Block Codes, Parity Check Matrix, Syndrome Testing, Error Detecting and Correcting Capability of Linear Block Codes, Hamming Codes, Probability of an Undetected Error for Linear Codes Over a BSC- Perfect Codes

UNIT – III

Cycle Codes : Algebraic Structure of Cyclic Codes, Binary Cyclic Code Properties, Encoding in Systematic Form, Syndrome Computation and Error Detection, Decoding of Cyclic Codes, Cyclic Hamming Codes

BCH Codes: Description of the Codes, Minimum Distance and BCH Bounds, Decoding Procedure for BCH Codes, Implementation of Galors Field Arithmetic, Implementation of Error Correction

UNIT-IV

Convolutional Codes: Encoding of Convolutional Codes, Structural Properties of Convolutional Codes, State Diagram, Tree Diagram, Trellis Diagram, Maximum, Likelihood Decoding of Convolutional Codes, Viterbi Algorithm, Sequential decoding algorithm

Text Books :

1. Error Control Coding – Fundamentals and Applications by SHU LIN and Daniel J. Costello, JR., Prentice Hall Inc
2. Simon Haykin – Communication Systems, 4th edition
3. Digital Communications – Fundamentals and Applications by Bernard Sklar, Pearson Education Asis, 2003
4. Digital Communications – John G. Proakis, Mc. Graw Hill Publications
5. J. Das, Sk. Mallik, PK Chattergee – Princiiples of Digital Communication NAI (P) Ltd, 2000

CSP 526/2 PATTERN RECOGNITION

UNIT – I
Introduction and basic concepts, Linear decision functions, Dichotomies, Classification by distance functions, Supervised learning

UNIT – II
Deterministic approach and statistical approach. Bayes decision theory and likelihood functions

UNIT – III
Feature selection. K.L expansion. Unsupervised learning

UNIT – IV
Elements of synthetic pattern recognition. Sequential and fuzzy pattern recognition

Text Books

1. Ton. JT & Gonzalez RC., Pattern Recognition. Addison Wesley press, 1974
2. Duda & Hart. Pattern Classification and Scene Analysis. Wiley 1973
3. ECE Dept., Recent development in Pattern recognition and digital techniques, February. 1977
4. FU KS Sequential methods in pattern recognition and machine learning. Academic press. 1968

CSP 526/3 RADAR SIGNAL PROCESSING

UNIT – I

Introduction – Radar functions and Applications, Target Detection, Resolution and Clutter , Basic Surveillance Radar – Implementation

Radar Engineering Equation – Parameters, loss factors, Radar Detection with Noise, Jamming, Volume Clutter and Area Clutter, Detection Probability, false alarm sensitivity and introductions to CFAR Technique, Basics of CACFAR processor, Resolution Cell and Measurement Accuracy, Ambiguities in Range and Doppler

UNIT – II

Signal Processing & Waveform Selection – 1 : Introduction, Matched Filter Processing (with examples), Matched Filter Receiver, Matched Filter and Correlation Function, Efficiency of Practical Filters, Effect of Transmitted waveform, Correlation Detection, Cross correlation Receiver

Detection Criteria, Neyman Pearson Observer, Ideal Observer, Sequential Observer, Likelihood, Ration, Maximum Likelihood Function, Inverse Probability Criterion, Uncertainty Relation

UNIT – III

Signal Processing & Waveform Selection – 1I : Transmit Waveforms, Types, Design Criteria, radar Ambiguity Function – Principles, Properties, Examples, Radar Environmental Diagram, Optimization, Desirability of Range – Doppler Ambiguities

Phase Coding Techniques : Principles, Random Binary coding, Binary periodic Sequences, Ambiguity Function for PR Sequences, Maximal Length Binary Codes, Perfect words and Codes, Poly Phase Codes. Decoding Techniques, Analog and Digital Schemes, Noise and Clutter Performances

UNIT – IV

Linear FM and Frequency Coding Techniques: Principles, Linear FM pulses, Generation and Decoding, Distortion effects on LFM Signals, Discrete Frequencies, Waveform Analysis, Capabilities, Resolution properties of Frequency Coded Pulses

Text Books:

1. F.E. Nathanson, Radar Design Principles – Signal Processing and the Environment , McGraw-Hill, First Edition (1969)
2. Ramon Nitzberg, radar Signal Processing and Adaptive Systems, Artech House, 1999
3. M.I. Skolnik, Introduction to Radar Systems, McGraw-Hill
4. M.I. Skolnik (ed.) Radar Hand Book, McGraw Hill, wnd ed, 1992

CSP 561 DSP LAB

1. Implementation of Edge Detection Techniques using DSP processor
2. Development of Digital Data Scrambler for speech signals
3. Development of Digital Data Descoraubler for speech an audio signal
4. Implementation of convolution encoder
5. Implementation of convolution veterbi decoder
6. Design and implementation of Digital Filters
7. Implementation of Digital filters for real time applications
8. Implementation JP&G algorithm for image compression
9. Implementation of Adaptive filters
10. Implementation real time system for biomedical signal using DSP processors
11. Application Development using DSP processor for Multi channel telephony system
12. Application Development for voice recognizing systems using DSP processors