

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**  
**M.Tech. DIGITAL ELECTRONICS & COMMUNICATIONS SYSTEMS 2005/06**  
**COURSE STRUCTURE**

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Course No.	Subject	Contact Hrs. / wk.
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**FIRST SEMESTER**

Digital System Design		4
Advanced Digital Signal Processing		4
Detection and Estimation of Signals		4
Digital Data Communications		4
<b>Elective –I</b>		4
Embedded and Real Time systems		
Network Security and Cryptography		
Neural Networks and Applications		
<b>Elective –II</b>		4
Advanced Operating Systems		
Advanced Computer Architecture		
Artificial Intelligence		
HDL Laboratory		3

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**SECOND SEMESTER**

Image Processing		4
Speech Processing		4
Coding Theory and Techniques		4
Micro Computer System Design		4
<b>Elective-III</b>		4
Design of Fault Tolerant Systems		
Low Power VLSI Design		
High Speed Networks		
<b>Elective-IV</b>		4
DSP Processors and Architectures		
Wireless Communications and Networks		
Radar Signal Processing		
Advanced Communications Laboratory		3

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**THIRD & FOURTH SEMESTERS**

SEMINAR  
PROJECT

**DIGITAL SYSTEM DESIGN**

**UNIT I**

DESIGN OF DIGITAL SYSTEMS: ASM charts, Hardware description language and control sequence method, Reduction of state tables, state assignments.

**UNIT II**

SEQUENTIAL CIRCUIT DESIGN: design of Iterative circuits, design of sequential circuits using ROMs and PLAs, sequential circuit design using CPLD, FPGAs.

**UNIT III**

FAULT MODELING: Fault classes and models – Stuck at faults, bridging faults, transition and intermittent faults.

TEST GENERATION: Fault diagnosis of Combinational circuits by conventional methods – Path Sensitization technique, Boolean difference method, Kohavi algorithm.

**UNIT IV**

TEST PATTERN GENERATION: D – algorithm, PODEM, Random testing, transition count testing, Signature analysis and testing for bridging faults.

**UNIT V**

FAULT DIAGNOSIS IN SEQUENTIAL CIRCUITS: State identification and fault detection experiment. Machine identification, Design of fault detection experiment.

**UNIT VI**

PROGRAMMING LOGIC ARRAYS: Design using PLA's, PLA minimization and PLA folding.

**UNIT VII**

PLA TESTING: Fault models, Test generation and Testable PLA design.

**UNIT VIII**

ASYNCHRONOUS SEQUENTIAL MACHINE: fundamental mode model, flow table, state reduction, minimal closed covers, races, cycles and hazards.

**TEXTBOOKS**

1. Z. Kohavi – “Switching & finite Automata Theory” (TMH)
2. N. N. Biswas – “Logic Design Theory” (PHI)
3. Nolman Balabanian, Bradley Calson – “Digital Logic Design Principles” – Wily Student Edition 2004.

**REFERENCES**

1. M. Abramovici, M. A. Breues, A. D. Friedman – “Digital System Testing and Testable Design”, Jaico Publications
2. Charles H. Roth Jr. – “Fundamentals of Logic Design”.
3. Frederick. J. Hill & Peterson – “Computer Aided Logic Design” – Wiley 4<sup>th</sup> Edition.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

M.Tech.(DECS) – I Semester

2005/06

## ADVANCED DIGITAL SIGNAL PROCESSING

### UNIT I

DISCRETE FOURIER TRANSFORMS: Properties of DFT, Linear Filtering methods based on the DFT, Overlap-save, Overlap -Add methods, frequency analysis of signals.

### UNIT II

FAST FOURIER TRANSFORMS : Radix-2 FFT and Split- Radix FFT algorithms The Goertzel and Chirp Z transform algorithms

### UNIT III

DESIGN OF IIR FILTERS: Design of IIR filters using Butterworth & Chebyshev approximations, frequency transformation techniques, structures for IIR systems –cascade, parallel, lattice & lattice-ladder structures.

### UNIT IV

DESIGN OF FIR FILTERS: Fourier series method, Windowing techniques, design of digital filters based on least – squares method, pade approximations, least squares design, wiener filter methods, structures for FIR systems –cascade, parallel, lattice & lattice-ladder structures.

### UNIT V

MULTI RATE SIGNAL PROCESSING : Decimation by a factor D, Interpolation by a factor I ,Sampling rate conversion by a rational factor I/D, Filter design & Implementation for sampling rate conversion.

### UNIT VI

POWER SPECTRAL ESTIMATION: Estimation of spectra from finite duration observation of signals, Non-parametric methods :Bartlett ,Welch & Blackmann & Tukey methods.

### UNIT VII

PARAMETRIC METHODS FOR POWER SPECTRUM ESTIMATION: Relation between auto correlation & model parameters, Yule-Waker & Burg Methods, MA & ARMA models for power spectrum estimation.

### UNIT VIII

Analysis of finite wordlength effects in fixed-point DSP systems – Fixed ,Floating Point Arithmetic – ADC quantization noise & signal quality – Finite wordlength effect in IIR digital Filters – Finite word-length effects in FFT algorithms.

## TEXTBOOKS

1. Digital Signal Processing –Principles, Algorithms Applications by J.G.Proakis & D.G.Manolokis, PHI.
2. Discrete Time signal processing - Alan V Oppenheim & Ronald W Schaffer, PHI.
3. DSP – A Pratical Approach – Emmanuel C.Ifeachar Barrie. W. Jervis, Pearson Education

## REFERENCES

1. Modern spectral Estimation techniques by S. M .Kay, PHI, 1997

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

M.Tech.(DECS) – I Semester

2005/06

## DETECTION AND ESTIMATION OF SIGNALS

### UNIT I

Introduction to Discrete-time signals:- Fourier Transform of a discrete time signal. Amplitude and phase spectrum. Frequency content and sampling rates. Transfer function. Frequency response.

### UNIT II

Random – Discrete-time signals:- Review of probability – Random data – Generation of Pseudo-random noise – Filtered signals – Autocorrelation and power spectral density – Sampling band – Limited random signals.

### UNIT III

Detection of signals in noise:- Minimum probability of Error Criterion – Neyman – Person criterion for Radar detection of constant and variable – amplitude signals – Matched filters. Optimum formulation – Detection of Random signals – Simple problems thereon with multisample cases.

### UNIT IV

Estimation of signals in noise:- Linear mean squared estimation – Non linear estimates – MLP and ML estimates – Maximum likelihood estimate of parameters of linear system. Simple problems thereon.

### UNIT V

Recursive linear mean squared estimation:- Estimation of a signal parameter. Estimation of time-varying signals – Kalman filtering – Filtering signals in noise – Treatment restricted to two variable case only – Simple problems.

### TEXT BOOKS

1. Signal processing: Discrete Spectral analysis, Detection and Estimation, Mischa Schwartz and Leonard Shaw, Mc-Graw Hill Book Company, 1975.

### REFERENCES

1. E.L. Van Trees, Detection, Estimation and Modulation Theory, Wiley, New York, 1968.
2. Shanmugam and Breipohl, 'Detection of signals in noise and estimation', John Wiley & Sons, New York, 1985.
3. Srinath, Rajasekaran & Viswanathan, Introduction to statistical Signal processing with Applications, Prentice Hall of India, New Delhi, 110 001,1989.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

M.Tech.(DECS) – I Semester

2005/06

**DIGITAL DATA COMMUNICATIONS**

**UNIT I**

**DIGITAL MODULATION TECHNIQUES**

FSK , MSK , BPSK , QPSK , 8-PSK , 16-PSK , 8- QAM , 16- QAM , Band width efficiency carrier recovery , DP , clock recovery , Probability of error and bit error rate.

**UNIT II**

Data Communications ; Serial , Parallel configuration , Topology , Transmission modes , codes , Error Control Synchronization, LCU.

**UNIT III**

Serial and Parallel Interfaces , Telephone Networks and Circuits , Data modems

**UNIT IV**

Data Communication Protocols , Character and block Mode ,Asynchronous and Synchronous Protocols, public Data Networks , ISDN.

**UNIT V**

**LOCAL AREA NETWORKS** : token ring , Ethernet , Traditional , Fast and GIGA bit Ethernet, FDDI

**UNIT VI**

**DIGITAL MULTIPLEXING** : TDM , T1 carrier , CCITT , CODECS, COMBO CHIPS , North American Hierarc , Line Encoding , T-carrier , Frame Synchronization Inter Leaving Statistical TDM FDM , Hierarchy ,Wave Division Multiplexing .

**UNIT VII**

**WIRELESS LANS**

IEEE 802.11 Architecture Layers , Addressing, Blue Tooth Architecture Layers, l2 Cap , Other Upper Layers .

**UNIT VIII**

**MULTI MEDIA**

Digitalizing Video and Audio Compression Streaming Stored and Live Video and Audio , Real Time Interactive Vide and Audio , VOIP

**TEXT BOOKS**

1. Electronic communication systems , fundamentals through advanced - W. TOMASI ,Pearson 4<sup>th</sup> Edition .
2. Data communication and networking - B.A. Forouzen

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

**M.Tech.(DECS) – I Semester**

**2005/06**

**EMBEDDED AND REAL TIME SYSTEMS  
(ELECTIVE I)**

**UNIT I**

**INTRODUCTION**

Embedded systems overview, design challenge, processor technology, IC technology, Design Technology, Trade-offs. Single purpose processors RT-level combinational logic, sequential logic (RT-level), custom single purpose processor design (RT-level), optimizing custom single purpose processors.

**UNIT II**

**GENERAL PURPOSE PROCESSORS**

Basic architecture, operation – pipelining, programmer’s view, development environment, Application Specific Instruction-Set Processors (ASIPs) – Micro Controllers and Digital Signal Processors.

**UNIT III**

**STATE MACHINE AND CONCURRENT PROCESS MODELS**

Introduction, models Vs. languages, finite state machines with data path model (FSMD), using state machines, program state machine model (PSM), concurrent process model, concurrent processes, communication among processes, synchronization among processes, implementation, data flow model, real-time systems.

**UNIT IV**

**COMMUNICATION INTERFACE**

Need for communication interfaces – RS232 / UART – RS422 / RS485 – USB – Infrared – IEEE 1394 Firewire – Ethernet – IEEE 802.11 – Blue tooth.

**UNIT V**

**EMBEDDED / RTOS CONCEPTS – I**

Architecture of the Kernel – Tasks and Task scheduler – interrupt service routines – Semaphores, Mutex.

**UNIT VI**

**EMBEDDED / RTOS CONCEPTS – II**

Mailboxes – Message Queues – Event Registers – Pipes – Signals

**UNIT VII**

**EMBEDDED / RTOS CONCEPTS – III**

Timers – Memory Management – Priority inversion problem – Embedded operating systems – Embedded Linux – Real-time operating systems – RT Linux – Handheld operating systems – Windows CE.

## **UNIT VIII**

### **DESIGN TECHNOLOGY**

Introduction, Automation, Synthesis, Parallel evolution of compilation and synthesis, Logic Synthesis, RT synthesis, Behavioral Synthesis, Systems Synthesis and Hardware/ Software Co-Design, Verification, Hardware/Software co-simulation, Reuse of intellectual property codes.

### **TEXT BOOKS**

1. Embedded System Design – A Unified Hardware/Software Introduction – Frank Vahid, Tony D. Givargis, John Wiley & Sons, Inc. 2002.
2. Embedded / Real Time Systems – KVKK Prasad, Dreamtech Press - 2005.
3. Introduction to Embedded Systems – Raj Kamal, TMS - 2002.

### **REFERENCE BOOKS**

1. Embedded Microcomputer Systems – Jonathan W. Valvano, Brooks / Cole, Thompson Learning.
2. An Embedded Software Primer – David E. Simon, Pearson Ed. 2005.

**NETWORK SECURITY AND CRYPTOGRAPHY**  
**(ELECTIVE I)**

**UNIT I**

**INTRODUCTION:** Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security.

**CLASSICAL TECHNIQUES:** Conventional Encryption model, Steganography, Classical Encryption Techniques.

**UNIT II**

**MODERN TECHNIQUES:** Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.

**ALGORITHMS:** Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block ciphers.

**UNIT III**

**CONVENTIONAL ENCRYPTION:** Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

**PUBLIC KEY CRYPTOGRAPHY:** Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

**UNIT IV**

**NUMBER THEORY:** Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

**MESSAGE AUTHENTICATION AND HASH FUNCTIONS:** Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

**UNIT V**

**HASH AND MAC ALGORITHMS:** MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC.

**DIGITAL SIGNATURES AND AUTHENTICATION PROTOCOLS:** Digital signatures, Authentication Protocols, Digital signature standards.

**UNIT VI**

**AUTHENTICATION APPLICATIONS:** Kerberos, X.509 directory Authentication service.

**ELECTRONIC MAIL SECURITY:** Pretty Good Privacy, S/MIME.

**UNIT VII**

**IP SECURITY:** Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management.

**WEB SECURITY:** Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

**UNIT VIII**

**INTRUDERS, VIRUSES AND WORMS:** Intruders, Viruses and Related threats.

**FIRE WALLS:** Fire wall Design Principles, Trusted systems.

**TEXT BOOKS**

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education., 2000.



**NEURAL NETWORKS AND APPLICATIONS  
(ELECTIVE I)**

**UNIT I**

**FUNDAMENTAL CONCEPTS AND MODELS OF ARTIFICIAL NEURAL SYSTEMS** Biological Neuron, Biological Neuron Models and their artificial models, McCulloch-Pitts Neuron Model, Neuron Modeling for Artificial Neuron Models Neuron Systems. Models of Artificial Neural Networks; Feed forward Network and feed backward Network. Neural Processing, learning and adaptation; Supervised and UnSupervised learning

**UNIT II**

**NEURAL NETWORK LEARNING RULES**

Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule Widrow-Hoff Rule, Correlation Learning Rule, Winner –Take-All Learning rule, Out Star Learning Rule, summary of Learning rules.

**UNIT III**

**SINGLE LAYER PERCEPTRON CLASSIFIERS**

Classification Model, Features and Decision Regions, Discriminant Functions ,linear Machine and Minimum Distance Classification, Nonparametric training concept Training and classification using the discrete perceptron: algorithm and example. Single Layer Continuous Perceptron Networks for Linearly Separable Classifications. Multicategory Single Layer Perceptron Networks.

**UNIT IV**

**MULTILAYER FEED FORWARD NETWORKS**

Linearly nonseparable pattern classification Delta Learning rule for Multiperceptron layer. Generalized Delta Learning rule. Feed forward Recall and Error Back Propagation Training; Examples of Error Back-Propagation. Training errors: Learning Factors; Initial weights, Cumulative Weight Adjustment versus Incremental Updating, steepness of activation function, learning constant, momentum method, Network architecture Versus Data Representation, Necessary number of Hidden Neurons. Application of Back propagation Networks in pattern recognition & Image processing, Madaunes: Architecture & Algorithms.

**UNIT V**

**SINGLE-LAYER FEEDBACK NETWORKS**

Basic concepts of Dynamical systems. Mathematical Foundation of Discrete-Time Hop field Networks. Mathematical Foundation of Gradient-Type Hopfield Networks. Transient response of Continuous time Networks. Example Solution of Optimization Problems: Summing networks with digital outputs, Minimization of the Traveling salesman tour length, Solving Simultaneous Linear Equations.

**UNIT VI**

**ASSOCIATIVE MEMORIES-I**

Basic concepts, Linear associator Basic concepts of Recurrent Auto associative memory; Retrieval algorithm. Storage algorithm, Storage Algorithms Performance considerations. Performance concepts of Recurrent Auto associative memory; Energy Function Reduction capacity of Recurrent Auto associative memory, Memory convergence versus Corruption, fixed point concept, modified memory Convergence towards fixed points, advantages and limitations.

## **UNIT VII**

### **ASSOCIATIVE MEMORIES-II**

Boltzman machines, Bidirectional Associative Memory; Memory architecture, association encoding and decoding, stability considerations, memory examples and performance evaluation, improved coding of memories, multidirectional Associative Memory. Associative Memory of Spatio-temporal Patterns

## **UNIT VIII**

**MATCHING AND SELF-ORGANIZING NETWORKS:** Hamming net and MAXNET Unsupervised learning of clusters. Clustering and similarity measures Winnerl take all learning ,recall mode, initialization of weights, separability limitations. Counter propagation networks. feature mapping: Self organizing feature maps, LVPS, Cluster discovery networks(ART1).

## **TEXT BOOKS**

1. J.M.Zurada: Introduction to Artificial Neural Systems, Jaico Publishers
2. Dr. B. Yagananarayana, Artificial Neural Networks, PHI, New Delhi.

## **REFERENCES**

1. Kishan Mehrotra, Chelkuri K. Mohan, Sanjay Ranka: Elements of Artificial Neural Networks, Penram International
2. Artificial Neural Network – By Simon Haykin, Pearson Education
3. Introduction Neural Networks Using MATLAB 6.0 - by S.N. Shivanandam, S. Sumati, S. N. Deepa,1/e, TMH, New Delhi.
4. Fundamental of Neural Networks – By Laurene Fausett

**ADVANCED OPERATING SYSTEMS  
(ELECTIVE II)**

**UNIT I**

Introduction to Operating Systems, Type of operating systems.

**UNIT II**

**UNIX – I**

Overview of UNIX system, Structure, file systems, type of file, ordinary & Special files, file permissions, Introduction to shell.

**UNIT III**

**UNIX – II**

UNIX basic commands & command arguments, Standard input / output Input / output redirection, filters and editors.

**UNIT IV**

**UNIX SYSTEMS CALLS**

System calls related file structures, input / output process creation & termination.

**UNIT V**

**INTERPROCESS COMMUNICATION IN UNIX**

Introduction, file and record locking, Client – Server example, pipes, FIFOs, Streams & Messages, Name Spaces, Systems V IPC, Message queues, Semaphores, Shared Memory, Sockets & TLI.

**UNIT VI**

**INTRODUCTION TO NETWORKS AND NETWORK PROGRAMMING IN UNIX :**

Network Primer, TCP/IP – Internet Protocols, Socket Programming – Introduction & overview, UNIX domain protocols, Socket Addresses, Elementary Socket system calls, Simple examples.

**UNIT VII**

**LINUX**

Introduction to LINUX System, editors and utilities, type of shells.

**UNIT VIII**

**LINUX OPERATIONS**

Shell operations, file structure, file management, Operations.

**TEXT BOOKS**

1. The design of the UNIX Operating Systems – Maurice J. Bach (PHI)
2. The UNIX Programming Environment (PHI) – Kernighan & Pike.
3. UNIX Network Programming - W. Richard Stevens (PHI) – 1998.
4. The Complete reference LINUX – Richard Peterson (TMH)
5. UNIX User Guide – Ritchie & Yates.

**ADVANCED COMPUTER ARCHITECTURE  
(ELECTIVE II)**

**UNIT I**

Fundamentals of Computer design- Technology trends- cost- measuring and reporting performance quantitative principles of computer design.

**UNIT II**

Instruction set principles and examples- classifying instruction set- memory addressing- type and size of operands- addressing modes for signal processing-operations in the instruction set- instructions for control flow-encoding an instruction set.-the role of compiler

**UNIT III**

Instruction level parallelism (ILP)- over coming data hazards- reducing branch costs –high performance instruction delivery- hardware based speculation- limitation of ILP

**UNIT IV**

ILP software approach- compiler techniques- static branch protection- VLIW approach- H.W support for more ILP at compile time- H.W verses S.W solutions

**UNIT V**

Memory hierarchy design- cache performance- reducing cache misses penalty and miss rate – virtual memory- protection and examples of VM.

**UNIT VI**

Multiprocessors and thread level parallelism- symmetric shared memory architectures- distributed shared memory- Synchronization- multi threading.

**UNIT VII**

Storage systems- Types – Buses - RAID- errors and failures- bench marking a storage device- designing a I/O system.

**UNIT VIII**

Inter connection networks and clusters- interconnection network media – practical issues in interconnecting networks- examples – clusters- designing a cluster

**TEXT BOOKS**

1. Computer Architecture A quantitative approach 3<sup>rd</sup> edition John L. Hennessy & David A. Patterson Morgan Kufmann (An Imprint of Elsevier)

**REFERENCES**

1. “Computer Architecture and parallel Processing” Kai Hwang and A.Briggs International Edition McGraw-Hill.
2. Advanced Computer Architectures, Dezso Sima, Terence Fountain, Peter Kacsuk, Pearson.

# **JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

**M.Tech.(DECS) – I Semester**

**2005/06**

## **ARTIFICIAL INTELLIGENCE (ELECTIVE II)**

### **UNIT I**

INTRODUCTION : AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

### **UNIT II**

SEARCHING: Searching for solutions, uniformed search strategies – Breadth first search, depth first search, Depth limited search, Iterative deepening depth first search bi-direction search - comparison. Search with partial information (Heuristic search) Greedy best first search, A\* search, Memory bounded heuristic search, Heuristic functions.

### **UNIT III**

Local search Algorithms, Hill climbing, simulated, annealing search, local beam search, genetical algorithms. CONSTRAIN SATISFACTION PROBLEMS: Backtracking search for CSPs local search for constraint satisfaction problems.

### **UNIT IV**

Game Playing: Adversial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Betapruning, Evaluation functions, cutting of search.

### **UNIT V**

Knowledge Representation & Reasons logical Agents, Knowledge – Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propos ional logic, Resolution, Forward & Backward. Chaining.

### **UNIT VI**

First order logic. Inference in first order logic, propositional Vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution.

### **UNIT VII**

Planning – Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state – space search, Forward states spare search, Backward states space search, Heuristics for stats space search. Planning search, planning with state space search, partial order planning Graphs.

### **UNIT VIII**

Learning – Forms of learning, Induction learning, Learning Decision Tree, Statistical learning methods, learning with complex data, learning with Hidden variables – The EM Algorithm, Instance Based learning, Neural Networks.

### **TEXT BOOKS**

Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Edn.  
Artificial Intelligence, 3<sup>rd</sup> Edition, Patrick Henry Winston., Pearson Edition

### **REFERENCES**

Artificial Intelligence , 2<sup>nd</sup> Edition, E.Rich and K.Knight (TMH).

Artificial Intelligence and Expert Systems – Patterson PHI

Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson

1. PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.

**HDL LABORATORY**

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**LIST OF EXPERIMENTS:**

1. Simulation and Verification of various gates like AND, OR, EXOR, NAND, NOR, and EXNOR
2. Design and simulate the HALF ADDER, SERIAL BINARY ADDER, MULTI-PRECISION ADDER using FULL ADDERS.
3. Simulation and verification of  
DECODER (2X4), (4X16 using 2X4 DECODER)  
MULTIPLEXERS (8X1, 16X1)  
PRIORITY ENCODER (4x2)with a VALID bit.  
Using various modeling styles (Structural, Behavioral, and Data Flow Modeling).
4. Modeling of D, J-K, T Flip-Flops with synchronous and Asynchronous reset,
5. Design and simulate of 4-bit  
COUNTER  
RING COUNTER, JOHNSON COUNTER,  
UP-DOWN COUNTER
6. Design a N-bit REGISTRARS performing  
SERIAL IN SERIAL OUT  
SERIAL IN PARALLLEL OUT  
PARALLEL IN SERIAL OUT  
PARALLEL IN PARALLEL OUT
7. Design MEALY AND MOORE FINITE STATE MACHINES for  
SEQUENCE DETECTOR-OVERLAPPING AND NON-OVERALAPPING
8. BUS COUNTER
9. Design the hardware for MULTIPLICATION and DIVISION (for 4 bit operands)
10. Design a ALU performing operations ADD, SUB, AND, OR, I's and 2's COMPLEMENT, MULTILICATION AND DIVISION



**IMAGE PROCESSING**

**UNIT I**

Image Processing Fundamentals – Image Transforms – Fourier Transform, Walsh, Handamard, DCT, Haar, Slant KL transforms and their properties.

**UNIT II**

Image Enhnacement- Enhancement by point processing, Histogram Processing, Enhancement in Spatial domain and in Frequency domain.

**UNIT III**

Color Image Processing – Fundamentals – Models – Pseudo Color image processing – Basics – Converting to other color spaces – Transformations - Color Smoothing and Sharpening – Color Segmentation – Noise – Color Noise Compression.

**UNIT IV**

Image Filtering and Restoration – Degradation Model – Diagnolisation of Circulant and Block Circulant Matrices – Algebraic approach to restoration- Inverse filtering – LMS Restoration – Constrained least Squares and iterative restoration, Geometric Transformations.

**UNIT V**

Image Compression – Fundamentals – Compression Models – Losleses and Lossy compressions – Compression Standards.

**UNIT VI**

Image Segmentation and Edge Detection – Detection of discontinuities – Edge linking and boundary detection – Region oriented segmentation – use of motion in segmentation – Marr-Hildreth Edge Detection – Canny Detectors.

**UNIT VII**

Representation and Description – Various shemes – Boundary Descriptors – Regional Descriptors

**UNIT VIII**

Morphological Image Processing – Preliminaries – Dilation & Erosion – Opening & Closing – Hit-Miss Transformation – Morphological algorithms – Extension to Grey Scale Images

**TEXT BOOKS**

1. Digital Image Processing - Rafael C.Gonzalez, Richard E. Woods, Pearson education, 2<sup>nd</sup> Edition.
2. Digital Image Processing Using MATLAB - Rafael C.Gonzalez, Richard E.Woods, Steven L.Edding, Pearson Education, 2<sup>nd</sup> Edition.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

**M.Tech.(DECS) – II Semester**

**2005/06**

**SPEECH PROCESSING**

**UNIT I:**

**FUNDAMENTALS OF DIGITAL SPEECH PROCESSING**

Anatomy & Physiology of Speech organs, The process of speech production, The acoustic theory of speech production, Digital models for speech signals.

**UNIT II**

**TIME DOMAIN MODELS FOR SPEECH PROCESSING**

Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech vs silence discrimination using Average energy and zero crossing, Pitch period estimation using parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function.

**UNIT III**

**LINEAR PREDICTIVE CODING (LPC) ANALYSIS**

Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of Lpc Equations: Cholesky Decomposition, Solution for Covariance Method, Durbin's Recursive Solution for the AutoCorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

**UNIT IV**

**HOMOMORPHIC SPEECH PROCESSING**

Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder.

**UNIT V**

**SPEECH ENHANCEMENT**

Nature of interfering sounds, Speech enhancement techniques, Spectral subtraction, Enhancement by re-synthesis.

**UNIT VI**

**AUTOMATIC SPEECH RECOGNITION**

Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System

## **UNIT VII**

### **HIDDEN MARKOV MODEL (HMM) FOR SPEECH**

Hidden markov model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS, Adapting to variability in speech, Language models.

## **UNIT VIII**

### **SPEAKER RECOGNITION**

Recognition techniques, Features that distinguish speakers, Speaker Recognition Systems: Speaker Verification System, Speaker Identification System.

#### **TEXT BOOKS**

1. L.R Rabiner and S.W.Schafer. Digital processing of speech signals, Pearson.
2. Douglas O Shaughnessy, Speech communication, Second Edition Oxford University press, 2000.
3. Fundamentals of Speech Recognition - L.R Rabiner and B.H.Juang.

#### **REFERENCE BOOKS:**

1. Discrete Time Speech Signal Processing- Thomas F. Quateri 1/e, Pearson
2. Speech & Audio Signal Processing- Ben Gold & Nelson Morgan, 1/e, Wiley

**CODING THEORY AND TECHNIQUES**

**UNIT – I:**

Source coding: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, coding for Discrete less sources, Source coding theorem, fixed length and variable length coding, properties of prefix codes.

**UNIT – II:**

Shannon-Fano coding, Huffman code, Huffman code applied for pair of symbols, efficiency calculations, Lempel-Ziv codes.

**UNIT – III:**

Linear Block codes: Introduction to Linear block codes, Generator 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.

**UNIT – IV:**

Hamming Codes, Probability of an undetected error for linear codes over a Binary Symmetric Channel, Weight Enumerators and Mac-Williams identities, Perfect codes, Application of Block codes for error control in data storage Systems.

**UNIT – V:**

Cyclic Codes: Algebraic structure of cyclic codes, Binary Cyclic code properties, Encoding in systematic and non-systematic form, Encoder using (n-k) bit shift register, Syndrome Computation and Error detection, Decoding of Cyclic Codes.

**UNIT –VI:**

Convolutional Codes: encoding of Convolutional codes, Structural properties of Convolutional codes, state diagram, Tree diagram, Trellis Diagram, maximum, Likelihood decoding of Convolutional codes.

**UNIT – VII:**

Viterbi Algorithm, Fano, Stack Sequential decoding algorithms, Application of Viterbi and sequential decoding.

**UNIT – VIII:**

BCH Codes: Groups, fields, binary Fields arithmetic, construction of Falois fields  $GF(2^m)$ , Basic properties of Falois Fields, Computation using Falois Field  $GF(2^m)$  arithmetic, Description of BCH codes, Decoding procedure for BCH codes.

**TEXT BOOKS:**

1. Error Control Coding – Fundamentals and Applications by SHU LIN and Daniel J. Costello, Jr. Prentice Hall Inc.
2. Digital Communications – Fundamental and Application by Bernard sklar, Pearson Education Asia.
3. Error Control Coding Theory by Man Young Rhee, Mc. Graw Hill Publ.

**REFERENCE BOOKS:**

1. Digital Communications – John G. Proakis, Mc. Graw Hill Publication.
2. Digital and Analog Communication Systems – K. Sam Shanmugam
3. Digital Communications by Symon Haykin.

# **JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**

**M.Tech.(DECS) – II Semester**

**2005/06**

## **MICROCOMPUTER SYSTEM DESIGN**

### **UNIT I**

Architectural advances of Intel XX86 Microprocessors series from 8086 to Pentium and Pentium Pro – Addressing Modes, Instruction Sets, Interrupt Processing.

### **UNIT II**

Software model of XX86 processors, Data organization, Memory Organisation, Programming with DOS and BIOS function calls.

### **UNIT III**

Virtual Memory Management: Virtual memory concept paging, segmentation, paging algorithms, cache memory organization, Associate memory organization.

### **UNIT IV**

RISC & CISC Concepts, Super scalar architecture, Pipelining, Branch Prediction, Instruction and data caches, Floating point Unit.

### **TEXTBOOKS**

1. James L. Antonakos: The Pentium Microprocessor (PHI) 1997.
2. Barry B. Brey: The Intel Microprocessors 8086/8088, 80188,80386,80486, Pentium-Pro Processor Architecture. Programming & Interfacing (PHI)4<sup>th</sup> Edn.1997.
3. John Uffenbeck : The 8086/8088 family design, Programming & interfacing, (PHI)1994

**DESIGN OF FAULT TOLERANT SYSTEMS  
(ELECTIVE III)**

**UNIT I**

**BASIC CONCEPTS:** Reliability concepts, Failure & Faults, Reliability and failure rate, Relation between reliability and Mean time between failure, Maintainability and Availability, Reliability of series, Parallel and Parallel-Series combinational circuits.

**UNIT II**

**FAULT TOLERANT DESIGN:** Basic concepts – Static, dynamic, hybrid, Triple Modular Redundant System, Self purging redundancy, Siftout redundancy (SMR), SMR Configuration, Use of error correcting code, Time redundancy and software redundancy.

**UNIT III**

**SELF CHECKING CIRCUITS:** Basic concepts of Self checking circuits, Design of Totally Self Checking checker, Checkers using m out of n codes, Berger code, Low cost residue code.

**UNIT IV**

**FAIL SAFE DESIGN:** Strongly fault secure circuits, fail-safe design of sequential circuits using partition theory and Berger code, totally self-checking PLA design.

**UNIT V**

**DESIGN FOR TESTABILITY FOR COMBINATIONAL CIRCUITS:** Basic concepts of testability, controllability and observability, the Reed Muller's expansion technique, OR-AND-OR design, use of control and syndrome testable design.

**UNIT VI**

Theory and operation of LFSR, LFSR as Signature analyzer, Multiple-input Signature Register.

**UNIT VII**

**DESIGN FOR TESTABILITY FOR SEQUENTIAL CIRCUITS:** Controllability and observability by means of scan register, Storage cells for scan design, classic scan design, Level Sensitive Scan Design (LSSD).

**UNIT VIII**

**BUILT IN SELF TEST:** BIST concepts, Test pattern generation for BIST exhaustive testing, Pseudorandom testing, pseudo exhaustive testing, constant weight patterns, Generic offline BIST architecture.

**TEXT BOOKS:**

1. Parag K. Lala – “Fault Tolerant & Fault Testable Hardware Design” (PHI)
2. M. Abramovili, M.A. Breues, A. D. Friedman – “Digital Systems Testing and Testable Design” Jaico publications.

**LOW POWER VLSI DESIGN  
(ELECTIVE III)**

**UNIT I**

LOW POWER DESIGN, AN OVER VIEW: Introduction to low- voltage low power design, limitations, Silicon-on-Insulator.

**UNIT II**

MOS/BiCMOS PROCESSES : Bi CMOS processes, Integration and Isolation considerations, Integrated Analog/Digital CMOS Process.

**UNIT III**

LOW-VOLTAGE/LOW POWER CMOS/ BICMOS PROCESSES: Deep submicron processes ,SOI CMOS, lateral BJT on SOI, future trends and directions of CMOS/BiCMOS processes.

**UNIT IV**

DEVICE BEHAVIOR AND MODELING: Advanced MOSFET models, limitations of MOSFET models, Bipolar models.

**UNIT V**

Analytical and Experimental characterization of sub-half micron MOS devices, MOSFET in a Hybrid- mode environment.

**UNIT VI**

CMOS AND Bi-CMOS LOGIC GATES: Conventional CMOS and BiCMOS logic gates. Performance evaluation

**UNIT VII**

LOW- VOLTAGE LOW POWER LOGIC CIRCUITS: Comparison of advanced BiCMOS Digital circuits. ESD-free Bi CMOS , Digital circuit operation and comparative Evaluation.

**UNIT VIII**

LOW POWER LATCHES AND FLIP FLOPS: Evolution of Latches and Flip flops-quality measures for latches and Flip flops, Design perspective.

**TEXT BOOKS**

1. CMOS/BiCMOS ULSI low voltage, low power by Yeo Rofail/ Gohl(3 Authors)-Pearson Education Asia 1<sup>st</sup> Indian reprint,2002

**REFERENCES**

1. Digital Integrated circuits , J.Rabaey PH. N.J 1996
2. CMOS Digital ICs sung-moKang and yusuf leblebici 3<sup>rd</sup> edition TMH 2003 (chapter 11)
3. VLSI DSP systems , Parhi, John Wiley & sons, 2003 (chapter 17)
4. IEEE Trans Electron Devices, IEEE J.Solid State Circuits, and other National and International Conferences and Symposia.

**HIGH SPEED NETWORKS  
(ELECTIVE III)**

**UNIT I**

**NETWORK SERVICES & LAYERED ARCHITECTURE**

Traffic characterization and quality of service, Network services, High performance networks, Network elements, Basic network mechanisms, layered architecture.

**UNIT II**

**ISDN & B-ISDN**

Over view of ISDN, ISDN channels, User access, ISDN protocols, Brief history of B-ISDN and ATM, ATM based services and applications, principles and building block of B-ISDN, general architecture of B-ISDN, frame relay.

**UNIT III**

**ATM NETWORKS**

Network layering, switching of virtual channels and virtual paths, applications of virtual channels and connections.

**UNIT IV**

QOS parameters, traffic descriptors, ATM service categories, ATM cell header, ATM layer, ATM adaptation layer.

**UNIT V**

**INTERCONNECTION NETWORKS**

Introduction, Banyan Networks, Routing algorithm & blocking phenomenon, Batcher-Banyan networks, crossbar switch, three stage class networks.

**UNIT VI**

**REARRANGEABLE NETWORKS**

Rearrangeable class networks, folding algorithm, bens network, looping algorithm.

**UNIT VII**

**ATM SIGNALING, ROUTING AND TRAFFIC CONTROL**

ATM addressing, UNI signaling, PNNI signaling, PNNI routing, ABR Traffic management.

**UNIT VIII**

**TCP/IP NETWORKS**

History of TCP/IP, TCP application and Services, Motivation, TCP, UDP, IP services and Header formats, Internetworking, TCP congestion control, Queue management: Passive & active, QOS in IP networks: differentiated and integrated services.

**TEXT BOOKS**

1. ISDN & B-ISDN with Frame Relay – William Stallings, PHI.
2. Communication Networks - Leon Garcia widjaja, TMH, 2000.
3. ATM Fundamentals – N. N. Biswas, Adventure books publishers, 1998.

## REFERENCES

1. High Performance TCP/IP Networking – Mahbub Hassan , Raj Jain, PHI, 2005.
2. ATM Networks – Rainer Handel, Manfred N. Hubber, Stefan Schroder, Pearson edu., 2002.
3. High Speed Networks and Internets – William Stallings, Pearson edu., 2002.
4. High Performance Communication Networks – T. Walrand & P. Varaiya, 2<sup>nd</sup> ed., Harcourt Asia Publ.



**DSP PROCESSORS AND ARCHITECTURES  
(ELECTIVE IV)**

**UNIT I**

**INTRODUCTION TO DIGITAL SIGNAL PROCESING**

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

**UNIT II**

**COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS**

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

**UNIT III**

**ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES**

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

**UNIT IV**

**EXECUTION CONTROL AND PIPELINING**

Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

**UNIT V**

**PROGRAMMABLE DIGITAL SIGNAL PROCESSORS**

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

**UNIT VI**

**IMPLEMENTATIONS OF BASIC DSP ALGORITHMS**

The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

**UNIT VII**

**IMPLEMENTATION OF FFT ALGORITHMS**

An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

**UNIT VIII**

**INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES**

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

**TEXT BOOKS**

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

**REFERENCES**

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M. Bhaskar, TMH, 2004.
2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005.

# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

M.Tech.(DECS) – II Semester

2005/06

## WIRELESS COMMUNICATIONS AND NETWORKS (ELECTIVE IV)

### UNIT I

WIRELESS COMMUNICATIONS & SYSTEM FUNDAMENTALS: Introduction to wireless communications systems, examples, comparisons & trends. Cellular concepts-frequency reuse, strategies, interference & system capacity, trucking & grade of service, improving coverage & capacity in cellular systems.

### UNIT II

MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION: FDMA, TDMA, SSMA (FHMA/CDMA/Hybrid techniques), SDMA technique (AS applicable to wireless communications). Packet radio access-protocols, CSMA protocols, reservation protocols, capture effect in packet radio, capacity of cellular systems.

### UNIT III

WIRELESS NETWORKING: Introduction, differences in wireless & fixed telephone networks, traffic routing in wireless networks – circuit switching, packet switching X.25 protocol.

### UNIT IV

Wireless data services – cellular digital packet data (CDPD), advanced radio data information systems, RAM mobile data (RMD). Common channel signaling (CCS), ISDN-Broad band ISDN & ATM, Signaling System no. 7 (SS7)-protocols, network services part, user part, signaling traffic, services & performance.

### UNIT V

MOBILE IP AND WIRELESS APPLICATION PROTOCOL: Mobile IP Operation of mobile IP, Co-located address, Registration, Tunneling, WAP Architecture, overview, WML scripts, WAP service, WAP session protocol, wireless transaction, Wireless datagram protocol.

### UNIT VI

WIRELESS LAN TECHNOLOGY: Infrared LANs, Spread spectrum LANs, Narrow band microwave LANs, IEEE 802 protocol Architecture, IEEE802 architecture and services, 802.11 medium access control, 802.11 physical layer.

### UNIT VII

BLUE TOOTH : Overview, Radio specification, Base band specification, Links manager specification, Logical link control and adaptation protocol. Introduction to WLL Technology.

### UNIT VIII

MOBILE DATA NETWORKS : Introduction, Data oriented CDPD Network, GPRS and higher data rates, Short messaging service in GSM, Mobile application protocol.

### TEXTBOOKS

1. Wireless Communication and Networking – William Stallings, PHI, 2003.
2. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, PHI, 2<sup>nd</sup> Edn., 2002.
3. Principles of Wireless Networks – Kaveh Pah Laven and P. Krishna Murthy, Pearson Education, 2002.

### REFERENCES

1. Wireless Digital Communications – Kamilo Feher, PHI, 1999.

**RADAR SIGNAL PROCESSING  
(ELECTIVE IV)**

**UNIT I**

Introduction [1] – Radar Block Diagram, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance [2] – General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, Bistatic Radar.

**UNIT II**

Detection of Radar Signals in Noise - I [3] : Matched Filter Receiver – Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and Cross-Correlation Receiver. Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise.

**UNIT III**

Detection of Radar Signals in Noise - II [3] : Detection Criteria – Neyman-Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer. Detectors – Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection - CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in Radar. Radar Signal Management – Schematics, Component Parts, Resources and Constraints.

**UNIT IV**

Waveform Selection [3, 2] : Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave, Periodic Pulse Train, Single Linear FM Pulse, Noiselike Waveforms. Waveform Design Requirements. Optimum Waveforms for Detection in Clutter, Family of Radar Waveforms.

**UNIT V**

Pulse Compression in Radar Signals : Introduction, Significance, Types. Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Sidelobes, Stretch Techniques, Generation and Decoding of FM Waveforms – Block Schematic and Characteristics of Passive System, Digital Compression, SAW Pulse Compression.

**UNIT VI**

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

**UNIT VII**

Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM). Sidelobe Reduction for Phase Coded PC Signals.

**UNIT VIII**

Other Types of PC Waveforms – Basics of Nonlinear Binary Phase Coded Sequences, Complementary Codes, Huffman Codes, Concatenated Barker Codes. Limiting in Pulse Compression, Cross-Correlation Properties, Compatibility. Comparison of Different Pulse Compression Waveforms.

**TEXT BOOKS**

- 1) M.I. Skolnik, Radar Handbook, McGraw Hill, 2<sup>nd</sup> ed., 1991.
- 2) Fred E. Nathanson, Radar Design Principles – Signal Processing and The Environment, PHI, 2<sup>nd</sup> ed., 1999.
- 3) M.I. Skolnik, Introduction to Radar Systems, TMH, 3<sup>rd</sup> ed., 2001.

**REFERENCES**

- 1) Peyton Z. Peebles, Jr., Radar Principles, John Wiley, 2004.
- 2) R. Nitzberg, Radar Signal Processing and Adaptive Systems, Artech House, 1999.
- 3) F.E. Nathanson, Radar Design Principles, McGraw Hill, 1<sup>st</sup> ed., 1969.

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**  
**DEPARTMENT OF ECE**

**M.Tech.(DECS) – II Semester**

**2005/06**

**ADVANCED COMMUNICATIONS LABORATORY**

\*Experiments involving Communication, Image Processing and Speech Processing using MATLAB.

Design and Simulation of

1. AM, FM Modulation and Demodulation.
2. QPSK Modulation and Demodulation
3. Costas loop for Carrier recovery.
4. TDMA (Time Division Multiple Access) technique.
5. CDMA (Code Division Multiple Access) technique
6. Effect of Sampling and Quantization of Digital Image.
7. Various Transforms (Fourier, Walsh, Hadamard).
8. Enhancement technique in spatial frequency domain.
9. Point line and edge detection techniques using derivative operators.
10. Color image enhancement techniques.
11. Echo cancellation in speech signal.
12. Filters using LMS Algorithm