**w.e.f. 2009-10**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA**
**KAKINADA 533 003**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**
**M. Tech- II Semester**

**Specialization: DECS**

## COURSE STRUCTURE

| Code | Name of the Subject | L | P | C | INT | EXT | TOTAL |
|---|---|---|---|---|---|---|---|
| **Core** | | | | | | | |
| | 1.Wireless Communication & Networks | 4 | - | 8 | 40 | 60 | 100 |
| | 2.Analog & Digital IC Design | 4 | - | 8 | 40 | 60 | 100 |
| | 3.DSP Processors & Architecture | 4 | - | 8 | 40 | 60 | 100 |
| | 4.Optical Communication | 4 | - | 8 | 40 | 60 | 100 |
| **Elective III** | | | | | | | |
| | 1. Radar Signal Processing | 4 | - | 8 | 40 | 60 | 100 |
| | 2. System Modeling & Simulation | | | | | | |
| **Elective IV** | | | | | | | |
| | 1. Internet Protocols | 4 | - | 8 | 40 | 60 | 100 |
| | 2. Network Security and Cryptography | | | | | | |
| **Laboratory** | | | | | | | |
| | Advanced Signal Processing Laboratory | - | 4 | 4 | 40 | 60 | 100 |

# WIRELESS COMMUNCIATIONS AND NETWORKS

## 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 bank 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, 2nd 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.

# ANALOG AND DIGITAL IC DESIGN

## UNIT-I

OPERATIONAL AMPLIFIERS**:** General considerations one – state op-amps, two stage op-amps-gains boosting stage- comparison I/P range limitations slew rate. CURRENT MIRRORS AND SINGLE STAGE AMPLIFIERS: simple COMS, 3JT current mirror,, Cascode Wilson Wilder current mirrors. Common Source amplifier source follower, common gate amplifier

NOISE: Types of Noise – Thermal Noise-flicker noise- Noise in opamps- Noise in common source stage noise band width.

## UNIT-II

PHASED LOCKED LOOP DESIGN: PLL concepts- The phase locked loop in the locked condition Integrated circuit PLLs – phase Detector- Voltage controlled oscillator case study: Analysis of the 560 B Monolithic PLL.

SWITHCHED CAPACITORS CIRCUITS: Basic Building blocks op-amps capacitors switches – non-over lapping clocks-Basic operations and analysis-resistor equivalence of la switched capacitor- parasitic sensitive integrator parasitic insensitive integrators signal flow graph analysis-First order filters- switch sharing fully differential filters – charged injections-switched capacitor gain circuits parallel resistor –capacitor circuit – preset table gain circuit – other switched capacitor circuits – full wave rectifier – peak detector sinusoidal oscillator.

## UNIT-III

LOGIC FAMILIES & CHARACTURISTICS : COMS, TTL, ECL, logic families COMS / TTL, interfacing comparison of logic families.

COMBINATIONAL LOGIC DESIGN USING VHDL: VHDL modeling for decoders, encoders, multiplexers, comparison, adders and subtractors .

SEQUENCIAL IC DESIGN USING VHD: VHDL modeling for larches, flip flaps, counters, shift registers, FSMs.

## UNIT-IV

DIGITAL INTEGRADED SYSTEM BUILDING BLOCKS: Multiplexers and decoders – barrel shifters counters digital single bit adder

MEMORIES: ROM: Internal structure 2D decoding commercial type timing and applications

CPLD: XC 9500 series family CPLD architecture – CLB internal architecture, I/O block internal structure .

FPGA: Conceptual of view of FPGA – classification based on CLB internal architecture I/O block architecture.

**UNIT-V**

COMPORATORS: Using an op-amp for a comparator-charge injection errors- latched comparator

NYQUIST RATE D/A CONVERTERS: Decoder based converter resistor storing converters folded resister string converter – Binary scale converters – Binary weighted resistor converters – Reduced resistance ratio ladders – R-2R based converters – Thermometer code current mode D/A converters.

NYQUIST RATE A/D CONVERTERS: Integrating converters – successive approximation converters. DAC based successive approximation – flash converters time interleaved A/D converters.

**REFERENCES:**


1. Analog Integrated circuit Design by David A Johns, Ken Martin, John Wiley & Sons.
2. Analysis and design of Analog Integrated Circuits, by Gray, Hurst Lewis, Meyer. John Wiley & Sons.
3. Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH
4. Digital Integrated Circuit Design by Ken Martin, Oxford University 2000
5. Digital Design Principles & Practices" by John F Wakerly, Pearson Education & Xilinx Design Series, 3rd Ed.(2002)


**SUGGESTED READING**


1. Ken Martin, Digital Integrated Circuit Design Oxford University,2000.
2. John F Wakerly, "Digital Design Principles & Practices", Pearson Education & Xilinx Design Series, 3rd Ed.(2002)
3. Samir Palnitkar, "Verylog HDL-A Guide to Digital Design and Synthesis", Prentice Hall India, (2002)
4. Douglas J Smith, "HDL Chip Design, a practical Guide for Designing, Synthesizing and simulating ASICs and FPGAs using VHDL or Verilog, Doone Publications, (1999).

# DSP PROCESSORS AND ARCHITECTURES

## 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.

# Optical Communication and Networks

**Unit –I**

**Overview of optical fiber communications:** The evolution of fiber optic systems, elements of an optical fiber transmission link. Advantages of optical fiber communication, applications.

**Unit – II**

**Optical Fibers:** structures, wave guiding, Nature of light, Basic optical laws and definitions, optical fiber modes and configurations (Fiber types, Rays and modes, step index and graded index fibers). mode theory of circular waveguides.

**Unit – III**

**Optical sources:** LEDs, structures, quantum efficiency, modulation capability, Laser diodes: Laser diodes and threshold conditions, external quantum efficiency resonant frequencies, laser diode structures and radiation pattern, temperature effects, reliability.

**Unit – IV**

**Photo Detectors:** Physical principles of photodiodes (pin Photodiode, avalanche, photo diode) comparison of photo detectors, noise in detectors.

**Unit – V**

Fabrication, cabling and installation: Fabrication, fiber optic cables, Installation- placing the cable.

**Unit – VI**

**Optical Communication Systems:** Block diagrams of optical communication systems, direct intensity modulation, digital communication systems, Laser semiconductor transmitter, Generations of optical fiber link, description of 8 Mb/s optical fiber communication link, description of 2.5 Gb/s optical fiber communication link.

**Unit – VII**

**Components of fiber optic Networks:** Overview of fiber optic networks, Transreceiver, semiconductors optical amplifiers, couplers/splicers, wavelength division multiplexers and de-multiplexers, filters, isolators and optical switches.

**Unit – VIII**

**Fiber Optic Networks:** Basic networks, SONET/SDIT, Broad cast and select WDM Networks, wavelength routed networks, optical CDMA.

**Text Books:**

1. Optical fiber communications – Gerd Keiser, 3 rd Ed. MGH.

2. Fiber Optic Communication Technology – Djafar K. Mynbaev and Lowell L. Scheiner, (Pearson Education Asia)

3. Optoelectronic devices and systems – S.C. Gupta, PHI, 2005.

**Reference:**

1. Fiber Optics Communications – Harold Kolimbiris (Pearson Education Asia)

2. Optical Fiber Communications and its applications – S.C. Gupta (PHI) 2004.

3. WDM Optical Networks – C. Siva Ram Murthy and Mohan Guru Swamy, PHI.

4. Fiber Optic communications – D.C. Agarwal, S.Chand Publications, 2004.

# RADAR SIGNAL PROCESSING

## (ELECTIVE III)

### 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 Compresssion Waveforms.

**TEXT BOOKS**

1) M.I. Skolnik, Radar Handbook, McGraw Hill, 2nd ed., 1991.

2) Fred E. Nathanson, Radar Design Principles – Signal Processing and The Environment, PHI, 2nd ed., 1999.

3) M.I. Skolnik, Introduction to Radar Systems, TMH, 3rd 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, 1st ed., 1969.

& Nelson Morgan, 1/e, Wiley

# SYSTEM MODELLING & SIMULATION

## (ELECTIVE III)

**UNIT I**

Basic Simulation Modeling, Systems, Models and Simulation, Discrete Event Simulation, Simulation of Single server queing system, Simulation of Inventory System, Alternative approach to modeling and simulation.

**UNIT II**

**SIMULATION SOFTWARE:**
Comparison of simulation packages with Programming Languages, Classification of Software, Desirable Software features, General purpose simulation packages – Arena, Extend and others, Object Oriented Simulation, Examples of application oriented simulation packages.

**UNIT III**
**BUILDING SIMULATION MODELS:**
Guidelines for determining levels of model detail, Techniques for increasing model validity and credibility.

**UNIT IV**
**MODELING TIME DRIVEN SYSTEMS:**
Modeling input signals, delays, System Integration, Linear Systems, Motion Control models, numerical experimentation.

**UNIT V**
**EXOGENOUS SIGNALS AND EVENTS:**
Disturbance signals, state machines, petri nets & analysis, System encapsulation.

**UNIT VI**
**MARKOV PROCESS**
Probabilistic systems, Discrete Time Markov processes, Random walks, Poisson processes, the exponential distribution, simulating a poison process, Continuous – Time Markov processes.

**UNIT VII**
**EVEN DRIVEN MODELS:**
Simulation diagrams, Queing theory, simulating queing systems, Types of Queues, Multiple servers.

**UNIT VIII**
**SYSTEM OPTIMIZATION:**
System identification, Searches, Alpha/beta trackers, multidimensional optimization, modeling and simulation methodology.

**TEXT BOOKS:**

1. System Modeling & Simulation, An introduction – Frank L.Severance, John Wiley&Sons, 2001.
2. Simulation Modeling and Analysis – Averill M.Law, W.David Kelton, TMH, 3rd Edition, 2003

**REFERENCE BOOK**:

1. Systems Simulation – Geoffery Gordon, PHI, 1978

# Internet Protocols

**Unit – 1**
**Introduction:** Internet administration and standards. The OSI model and TCP/IP protocol, TCP/IP Versions.
**Unit – 2**

**Internet Protocol – Part 1:** IP addressing, different classes, subnetting, supernetting.

**Unit – 3**

Delivery and routing of IP packets, IP design, ARP and RARP.

**Unit – 4**

**Internet Protocol – Part III:** Internet control message protocol, message format, error reporting and query, ICMP design, Internet group message protocol and its design, user datagram protocol, operation and design.

**Unit – 5**

**Transmission Control Protocol:** TCP services, flow control, error control, connection, congestion control, TCP design and operation, routing protocols, RIP, OSPF and BGP.

**Unit – 6**

BOOTP and DHCP, DNS name space, distribution of name space, DNS resolution, types of records, Telnet and remote login.

**Unit – 7**

File Transfer Protocol, connection, communication and command processing, TFTP, simple mail transfer protocol, addresses, mail delivery, multipurpose Internet mail extensions. Post office protocol.

**Unit – 8**

Simple Network Management Protocol, Hypertext Transfer Protocol, Next Generation IP Protocols, IPv6.

**Text Books:**

1.TCP/IP Protocol Suite – By Behrouz A. Porouzan, TMH, ed.-2000.

2. Internet Working with TCP/IP Vol.I: Principles, Protocols and Architecture – by Douglas E. Comes. (PHI) - 1997.

# NETWORK SECURITY & CRYPTOGRAPHY

## (ELECTIVE IV)

### UNIT I

**Introduction:** Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Inter-network security.

Classical Techniques: Conventional Encryption model, Steganograpjy, 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 operation.

Algorithms: Triples DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers.

### 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 primarily, 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. **William Stallings,** Cryptography and Network Security: Principles and Practice, Pearson Education.
2. **William Stallings,** Network Security Essentials (Applications and Standards) Pearson Education.

**REFERENCE BOOKS**

1. **Eric Maiwald** ,Fundamentals of Network Security (Dreamtech press)
2. **Charlie Kaufman, Radia Perlman and Mike Speciner,** Network Security – Private Communication in a Public World, Pearson/PHI.
3. **Whitman, Principles** of Information Security, Thomson.
4. **Robert Bragg,** Network Security The Complete reference, Mark Rhodes, TMH

**Buchmann,** Introduction to Cryptography, Springer.

# ADVANCED SIGNAL PROCESSING LABORATORY

**The students are required to simulate the following experimental parts on the MATLAB environment by consider the relevant application based examples.**

## PART-1: Digital Signal Processing

1. Discrete-time Signals and Systems in the time domain.
2. z-Transforms and inverse z-Transforms.
3. The Discrete Fourier Transform properties.
4. FIR Filter Design.
5. IIR Filter Design.
6. Applications in Adaptive Filtering.

## PART-2: Image Processing

1. Image Enhancement.
2. Enhancement in Frequency Domain.
3. Image Segmentation.
4. Image Compression.
5. Morphological Operations.
6. Recognition based decision theoretic methods.

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