
ANTENNA ARRAYS – Point source, Array of two isotropic point sources. Uniform array of N point sources and array factor –Examples of 4 element broadside and endfire arrays. N-element linear array of elementary dipoles and principle of pattern multiplication. Two element array of elementary dipoles - Excitation with different relative phase shift and for different spacing.


Suggested Readings:

5. T. Milligan, Microstrip Antenna Design, Wiley, 2005

7ECU02 DIGITAL SIGNAL PROCESSING

L:-3 T:-1 M.M.-150

**SAMPLING** - Discrete time processing of Continuous-time signals, continuous time processing of discrete-time signals, Changing the sampling rate using discrete-time processing.

**TRANSFORM ANALYSIS OF LTI SYSTEMS** - Introduction, The frequency response of LTI systems, System functions for systems characterized by LCCD (Linear Constant Coefficient Difference) equations, All-pass system, Minimum-Phase systems, Linear systems with linear phase.

**STRUCTURES FOR DISCRETE-TIME SYSTEMS** - Block diagram and signal flow graph representation of LCCD equations, Basic structures for IIR and FIR systems, Transposed forms.


**DFT, FFT** - The Discrete Fourier transform (DFT), Properties of the DFT, Linear Convolution using DFT, Efficient computation of the DFT: Decimation-in-Time and Decimation-in-frequency FFT Algorithms.

**Suggested Readings**

4. Introduction to Digital Signal Processing using MATLAB, Schilling, 2011

7ECU03 DIGITAL IMAGE PROCESSING
DIGITAL IMAGE FUNDAMENTALS: Image sensing and acquisition, Image sampling and quantization, Representing digital images, Spatial and gray-level resolution, Spatial operations, Vector & matrix operations, Zooming and Shrinking of digital images. RGB and HSI Color models

BASIC IMAGE OPERATIONS: Intensity transformation functions, Histogram equalization, Spatial filtering for image smoothing, Image sharpening by first and second order derivatives, Image smoothing and sharpening using frequency domain filters

IMAGE RESTORATION: Image restoration model, Noise Models, Spatial and frequency properties of noise, noise probability density functions, Noise only-spatial filter, Mean, order Statistic and adaptive filters, Concepts of inverse and Wiener filtering

MORPHOLOGICAL IMAGE PROCESSING: Erosion and Dilation, Opening and closing, morphological algorithms for Boundary extraction, thinning, pruning, smoothing and thickening

IMAGE SEGMENTATION AND COMPRESSION: Edge based segmentation, Edge detection masks, Gradient operators, Thresholding, Region growing, Watershed transform, Fundamentals of image compression; Loss-less compression techniques; Lossy compression techniques, compression standards

Suggested Readings:


7ECUO4 WIRELESS COMMUNICATION

Spread Spectrum Modulation Techniques – Concept of spread spectrum, system processing gain, Spread Spectrum signals: Direct-sequence spread spectrum signals, Frequency-hopped spread spectrum signals, Code-division multiplexing, Spreading codes

Wireless Microwave Communication- Link Engineering, Frequency planning, Free space loss, Fresnel zone clearance, bending of radio beam,
Effective earth radius, Fundamentals of fading, types and effects, Multipath channels; parameters, measurements, Building blocks of Transmitter & Receiver.

**Multiple Access Techniques and Networks** - FDMA, TDMA and CDMA with reference to mobile radio and satellite systems. TDMA based networks, OFDM and its characteristics, Packet radio multiple access techniques. CDMA based networks: Architecture, Air interface, Call processing, power control, Rake receiver concept and performance of CDMA system.


**Satellite Communication** - Elements of satellite communication: Frequency bands, Transmission and Multiple access. Satellite orbit and description-orbital period and velocity, effects of orbital inclination, Azimuth and elevation, Coverage angle and slant range, Satellite Link: basic link design and analysis, Geostationary orbit, Satellite subsystems. Earth Station antenna, high-power amplifier, low-noise amplifier, up converter, down converter, monitoring and control, reliability

**Suggested Readings:**

8. Wireless Communications and Networking, Price, TMH, 2014
9. Pratt, Bostain, Satellite Communications, Wiley India, 2011

**7ECU05 VLSI DESIGN**
INTRODUCTION TO MOSFET- Basic MOS transistors, Enhancement Mode transistor action, Depletion Mode transistor action, NMOS and CMOS fabrication. Aspects of threshold voltage, threshold voltage with body effect.Ids versus Vds relationship, channel length modulation. Transistor Trans-conductance gm. MOS transistor circuit Model, Model parameter (oxide and junction capacitor, channel resistance) variation with scaling and biasing. High order effects (i.e. subthreshold conduction, hot electron effect, narrow channel effect and punch through effect.

CMOS LOGIC CIRCUITS- nMOS inverter (resistive and active load), Pull up to Pull down ratio for a NMOS Inverter and CMOS Inverter (Bn/Bp), determination of inverter parameter (VIL, VIH VOL VOH) and Noise Margin. Speed and power dissipation analysis of CMOS inverter. Combinational Logic, NAND Gate, NOR gate, XOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers, Transmission Gate, estimation of Gate delays, Power dissipation and Transistor sizing.

Basic physical design of simple Gates and Layout issues. Layout issues for CMOS inverter, Layout for NAND, NOR and Complex Logic gates, Layout of TG, Layout optimization using Euler path. DRC rules for layout and issues of interconnects, Latch up problem.

Dynamic CMOS circuits- Clocked CMOS (C2MOS) logic, DOMINO logic, NORA logic, NP(ZIPPER) logic, PE (pre-charge and Evaluation) Logic. Basic Memory circuits, SRAM and DRAM.

Physical Design- Introduction to ECAD tools for first and back end design of VLSI circuits. Custom /ASIC design, Design using FPGA and VHDL. VHDL Code for simple Logic gates, flip-flops, shift registers

Suggested Readings:


7ECU06.1 ADVANCED MICROPROCESSORS

The 8086 Microprocessor Family: 8086 ARCHITECTURE- Hardware specifications, Pins and signals, Internal data operations and Registers, Minimum and maximum mode, System Bus Timing, Linking and execution of Programs
Software & Instruction Set: Assembly language programming: addressing mode and instructions of 8086, Strings, Procedures and Macros, 8086 interrupts. Assembler Directives and operators.

Analog Interfacing: A/D and D/A converter interfacing, keyboard and display interfacing, RS 232 & IEEE 488 communication standards. An 8086 based Process Control Systems

Digital Interfacing: Programmable parallel ports, Interfacing microprocessor to keyboard and alphanumeric displays, Memory interfacing and Decoding, DMA controller.

Multiprocessor Configurations: Multiuser / Multi tasking operating system concepts, 8086 based Multiprocessor systems. Introduction and basic features of 286, 386, 486 & Pentium processors.

Suggested Readings:

7. The 8086 Microprocessor: Programming & Interfacing the PC, Ayala, cengage learning, 2007

7ECU06.2 ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

L:-3 T:-0 M.M.-150

Introduction to Artificial Intelligence: Intelligent Agents, State Space Search, Uninformed Search, Informed Search, Two Players Games, Constraint Satisfaction Problems.

Knowledge Representation: Knowledge Representation And Logic, Interface in Propositional Logic, First Order Logic, Reasoning Using First Order Logic, Resolution in FOPL


KNOWLEDGE SYSTEMS: Rule Based Expert System, Reasoning with Uncertainty, Fuzzy Reasoning
**KNOWLEDGE ACQUISITION:** Introduction to Learning, Rule Induction and Decision Trees, Learning Using neural Networks, Probabilistic Learning Natural Language Processing

**Suggested Readings:**

7. Siman Haykin, “Neural Netowrks” Prentice Hall of India 1990
8. Artificial Intelligence, Kaushik, cengage learning 1997

**ECU06.3 VHDL**

**INTRODUCTION:** VHDL/PLD Design Methodology, Advantages, Requirement Analysis and specification, VHDL description, Verification Using simulations, Functional Simulation, Logic Synthesis, Place and route and timing Simulation Fundamental & history of various hardware description language, VHDL for Synthesis V/s Simulation, Design flow of ASICs and standard logic circuits. Implementation Details for SPLDs, CPLDs and FPGAs

**LANGUAGE FUNDAMENTALS:** Entities, Architectures and coding Styles, Signals and Data types, Packages, Dataflow, Structural, Behavioral and RTL Style of Combinational design, Event- Driven Simulation: Simulation Approaches, Elaboration Signal Drivers Simulator Kernel process, Signals verses Variables.

**COMBINATIONAL and SEQUENCIAL CIRCUITS BUILDING BLOCKS:** Multiplexer, Synthesis using Shannon’s expansions, Decoders, encoders, Code Converters, VHDL Code for Combinational Circuits. VHDL code for Flip-Flops, shift registers, Counters.

**SYNCHRONOUS/ ASYNCHRONOUS SEQUENCIAL CIRCUITS:** Mealy & Moore type FSMs, VHDL Code for Mealy & Moore Machines, VHDL Codes for Serial Adder, Vending Machine.

**DIGITAL SYSTEM DESIGN:** Building Block circuits, Memory organization, SRAM, Design examples of divider, Multiplier, Shifting & Sorting Operations, Clock Synchronization, CPU organization and design concepts.

**Suggested Readings:**

2. VHDL for Engineers, Short, Pearson. (2011)
3. VHDL (Suggested Readings Binding), Douglas L. Perry, TMH 2002
4. VHDL, A design oriented Approach, S S Limaye, TMH 2008
5. VHDL: Programming By Example, Douglas Perry, Oxford 2002
6. The Designer's Guide To VHDL, Peter J. Ashenden, Oxford 2010
7. Circuit Design With VHDL , By Volnei A Pedroni, PHI 2004
8. VHDL Bascis to programming, Gaganpreet Kaurt, Pearson 2013
10. HDL Programming Fundamentals VHDL & VERILOG. Botros. cengage learning 2002

7ECU07 SIGNAL AND IMAGE PROCESSING LAB

P:-3 M.M.-75

1. To simulate the transmitter and receiver for BPSK
2. To design and simulate FIR digital filter (LP/HP).
3. To design and simulate IIR digital filter (LP/HP).
4. Reading and displaying Gray/Colour images of different formats
5. RGB/HSI conversions in an image, Image arithmetic operations.
6. Image Histogram and histogram equalization
7. Image filtering in Spatial and frequency domain
8. Morphological operations in analyzing image structures
9. Thresholding-based image segmentation
10. Study of image compression

7ECU08 WIRELESS COMMUNICATION LAB

P:-3 M.M.-75

1. Measurement of antenna input characteristics: Measure the input return loss versus frequency in the operating band for (i) Half wave dipole (printed dipole/strip dipole), (ii) Folded dipole and (ii) Log-periodic antenna.
2. Measurement of radiation characteristics of a (i) Half wave dipole (printed dipole/strip dipole), and (ii) Printed Yagi antenna -Measure radiation patterns in the two principal planes and plot on polar chart. Determine beam width, directivity and antenna efficiency.
3. Measurement of antenna gain using absolute gain and relative gain measurements:
   ▪ Measure gain of Bi-quad antenna using absolute gain measurements.
   ▪ Measure gain of log-periodic antenna and printed slot antenna using relative gain measurements.
5. Antenna array theory demonstration using single EM coupled rectangular patch, 2x1 EM coupled and 2x2 EM coupled rectangular patch antennas.
6. Communication link budget calculations- Friis formula and demonstration with transmit and receive antenna setup.
7. Radar Trainer: Working of Doppler radar, velocity of moving object, time and frequency measurement and other applications.
8. To perform Modulation, Demodulation and BER measurement using CDMA – DSSS Trainer.
10. To study GPS Receiver, establishing link between GPS satellite & GPS trainer and measure of latitude & longitude

**SECU01 IC TECHNOLOGY**

L:-3  T:-0  M.M.-150

**INTRODUCTION TO IC TECHNOLOGY**- Semiconductor Substrate Crystal defects, Electronic Grade Silicon, Czochralski Growth, Float Zone Growth, Characterization & evaluation of Crystals; Wafer Preparation- Silicon Shaping, Etching and Polishing, Chemical cleaning.

**DIFFUSION & OXIDATION** - Ficks diffusion Equation in One Dimension, Atomic model, Analytic Solution of Ficks Law, correction to simple theory, Diffusion in SiO2. Ion Implantation and Ion Implantation Systems. Oxidation Growth mechanism and Deal-Grove Model of oxidation, Linear and Parabolic Rate co-efficient, Structure of SiO2, Oxidation techniques and system, Oxide properties.

**CHEMICAL VAPOUR DEPOSITION AND EPITAXIAL LAYER GROWTH**- CVD for deposition of dielectric and polysilicon thick Layer – a simple CVD system, Chemical equilibrium and the law of mass action, Introduction to atmospheric CVD of dielectric, low pressure CVD of dielectric and semiconductor. Epitaxy-Vapour Phase Expitaxy, Defects in Epitaxial growth, Metal Organic Chemical Vapor Deposition, Molecular beam epitaxy.

**PATTERN TRANSFER & ETCHING** - Introduction to photo/optical lithography, Contact/ proximity printers Projection printers, Mask generation, photo resists. Dry & Wet etching, methods for anisotropic etching, Plasma etching, Reaction ion etching (RIE).

**VLSI PROCESS INTEGRATION**- Junction and Oxide Isolation, LOCOS methods, Trench Isolation, SOI; Metallization, Planarization. Fundamental consideration for IC Processing, NMOS IC Technology, CMOS IC Technology, Bipolar IC Technology. Fault diagnosis and characterization techniques.

**Suggested Readings**

SECU02 RADAR & TV ENGINEERING

L:-3 T:-1 M.M.-150

RADAR - Radar Block diagram, frequencies and applications. Radar range equation. Continuous wave (CW) & FM radar; Moving target indicator (MTI): Delay line cancellers, blind velocity Pulse Doppler Radar. Tracking radar sequential lobbing, Conical scan and monopulse radar, Types of display, Radar receivers, Noise figure. NAVIGATIONAL AIDS - Principle of operation of Radar direction finder & range system. LORAN system, DME, TACAN, Aircraft landing systems.


Processing and transmission of TV signals: Modulation of video and sound signals, Vestigial side band transmission, Compatibility of colour and monochrome frequency interleaving & transmission of colour signals, Picture, sound and colour sub carriers. Encoding picture information. Generation of colour, colour difference and Chrominance signal modulation.TV transmission & reception antennas.


MODERN TV SYSTEM: Digital transmission and reception of TV signals, DISHTV, DTH and cable TV, transmission of TV signals through Satellite and Transponders, working principles of HDTV, DBS-TV, IPTV and 3D-TV. Modern TV receiver with LCD, LED and Plasma displays.

Suggested Readings:

3. Television Engineering and Video System, R G Gupta, MGH, 2005
4. Television and Video Engineering , A M Dhake, MGH, 1995

Nano Fabrication and Patterning Techniques: Si processing methods, Cleaning/etching, Oxidation, Gettering, doping, Epitaxy. CVD & MOCVD, Physical Vapor Deposition (PVD), Liquid Phase Techniques, Self assembly and catalysis. Etching: Wet and Dry, Nanolithography, Nanoimprinting, XRay Lithography(XRL), Particle beam lithography(e-beam, FIB, shadow mask evaporation).


Electrical, Magnetic, Mechanical and Optical Properties and Applications: Electronic and electrical properties -One dimensional systems-Metallic nanowires, Quantum dots -Two dimensional systems - Quantum wells. Magnetic properties -Transport in a magnetic field. Mechanical properties, Optical properties, Evolving interfaces of Nano in NanoBiology, Nano Sensors and Nanomedicines


Suggested Readings
3. Fundamental of Nanoelectronics, George W. Hanson, Pearson 2009
4. Principal of Nanotechnology, G. A. Mansoori, Wiley 2005
8. MEMS & Microsystems, Design and Manufacture, Tai-Ran HSU, TMH 2013
SECU04.1 COMPUTER NETWORKS

L:3 T:0 M.M.-150

**Queuing Theory** - Pure birth, Pure death & Birth-death processes, Mathematical models for M/M/1, M/M/∞, M/M/m, M/M/1/K and M/M/m/m queues. Little's formula.

**Physical and Data link layer** – OSI model & TCP/IP reference models, Line coding schemes, Packet & Circuit switching, Virtual circuit network, Framing, Simplex protocol, Simplex stop & wait protocol, Sliding window protocol, Go back N protocol, selective repeat, HDLC, PPP

**MAC Sublayer** - Static & dynamic channel allocation, Multiple Access Protocols: ALOHA, slotted ALOHA, CSMA, Token Bus, Token Ring, FDDI IEEE standards 1002.3 & 1002.5, Virtual circuit network: frame relay & ATM frame and protocol architecture, 3 Network connection devices: Hubs, Bridges, switches, Routers and Gateways

**Network Layer** - IPv4 & IPv6 addressing and datagram, Internetworking, Non-adaptive & Adaptive routing algorithms, Distance vector routing and Link state routing algorithms, OSPF and BGP

**Transport and Application Layer** - Client server paradigm, TCP frame format, Data traffic descriptors, QoS, Congestion and its control algorithms, Improving QoS by different queuing schemes, leaky bucket and token bucket implementation, Domain name, DNS in the internet, SMTP, FTP, WWW, HTTP

**Suggested Readings**

7. Fundamentals of Networking and Data Communications, White, cengage learning, 2013

SECU04.2 OPERATING SYSTEMS

L:3 T:0 M.M.-150

**INTRODUCTION** – History, Operating system services, types, responsibilities, generations, LINUX, WINDOWS.

**PROCESS MANAGEMENT** - Operations on process, Process state, Scheduling, Criteria, scheduling algorithms, Evaluation, Synchronization, Semaphores, Monitors.
MEMORY MANAGEMENT- Swapping, Continuous memory allocation, Paging, Pure paging, Demand paging, Page-replacement algorithms, thrashing, Example-Pentium, Disk Scheduling.


DEAD LOCKS- System model, Dead lock characterization, Deadlock prevention, Avoidance, Detection, Recovery, Classic problems of synchronization.

Suggested Readings:

8ECU04.3 MICROCONTROLLERS & EMBEDDED SYSTEMS


8051 ASSEMBLY LANGUAGE PROGRAMMING: Addressing modes, External data moves, Stack,Push and Pop opcodes, Logical operations, Byte level and bit level logical operations. Arithmetic operations, Jump and call instructions, Interrupts & returns.

TIME CONTROL: Interrupts, Multiple sources of interrupts, Non maskable sources of interrupts, Interrupt structure in 8051,Timers,Free running counter & Real Time control.

SYSTEM DESIGN: Serial I/O interface, Parallel I/O ports interface, Digital and Analog interfacing methods, LED array, keyboard, Printer, Flash memory interfacing.

INTRODUCTION TO EMBEDED SYSTEM: Application of Microcontrollers in interfacing, MCU based measuring instruments. Real Time Operating System for System Design, Multitasking System, Task Definition in a Multitasking
System, Round Robin Scheduling, Full Preemptive Scheduling, Basic study and Features of Commercial RTOS : WINCE and Embedded Linux.

**Suggested Readings:**

2. Rajkamal, “Embedded Systems” TMH
5. The 8051 Microcontrollers & Embedded Systems,Mazidi, ,PHI 2004
6. The 8051 Microcontroller, Ayala, cengage learning 2009
7. The 8051 Microcontroller & Embedded Systems using Assembly and C, Ayala /Gadre cengage learning 2005
10. Embedded System Design Using C8051 , Huang , cengage learning
11. Embedded Microcomputer System Real Time Interfacing, Valvano , cengage learning

**8ECU05 RF FABRICATION LAB**

**P:-3**

1. Design and fabricate the following Planar Transmission Lines:
   - Stripline and microstrip lines
   - Parallel coupled striplines and microstrip lines
   - Slot lines and Coplanar lines
   Measure their S-parameters and Characteristic impedance.
2. Design and Fabricate the following:
   - 3-dB branchline coupler,
   - backward wave coupler,
   - Wilkinson power dividers
   - Low pass filters
   - band pass filters.

   Measure their S-parameters & frequency responses.
3. Design, fabrication, and measurement of RF amplifier using microwave BJT.

**8ECU06 INDUSTRIAL ECONOMICS & MANAGEMENT**

**P:-2**

**M.M.-50**
2. Approaches to industrial location analysis, Productivity analysis, Input-Output analysis, Concentration of economic power. New Industrial Policy – Critical analysis, Role of technology and entrepreneurship in industrial development.
3. Industrial project appraisal- classification of industries, industrial legislations in India, recent trends in MNCs, LPG, FDI & joint ventures, methods of project evaluation-NPV, CBA, IRR, break-even analysis.
4. Management- Principles of management, functions of management planning, organizing, staffing, directing, controlling, co-ordinating, decision making
5. Emerging issues- Total quality management, JIT, quality circle, KANBAN, benchmarking, six sigma, quality management, ISO 9000, ISO 14000, Customer relationship management (CRM).

Suggested Readings:

1. Subburay, Total quality management, TMH. (2011)
2. Barthwal R.R- industrial economics . wiley eastern limited
3. Tirole jean – the theory of industrial organization . MIT PRESS

SEC7A VLSI DESIGN & OPTICAL FIBER LAB

PART-I: Design and simulation of following VLSI circuits using EDA Tools (Software) Schematic design and make Device Level Layout of following circuits.

1. Design 2-input NAND, NOR and XOR using CMOS logic. Obtain its static and dynamic analysis for speed and power dissipation.
2. Design 2X1 and 4X1 Multiplexer using Transmission Gate (TG. Obtain its static and dynamic analysis for speed and power dissipation.
3. Design a SR-latch and D-latch using CMOS. Obtain its static and dynamic analysis for speed and power dissipation.
4. Design a SRAM and DRAM Memory Cell. Obtain its static and dynamic analysis for speed and power dissipation.

PART-II Design and simulation of following VLSI circuits using VHDL and then burn/implement the circuits on FPGA kit for real input.

5. Design a 4-bit parallel Adder. Obtain its number of gates, area, and speed and power dissipation.
6. Design a 4-bit Serial in-serial out shift register. Obtain its number of gates, area, and speed and power dissipation.
7. Design a 4-bit binary synchronous counter. Obtain its number of gates, area, and speed and power dissipation.

PART-III. To perform following experiments based on Fiber Optic Trainer.

8. To set up Fiber Optic Analog link.
9. To set up Fiber Optic Digital link.
11. Characterization (VI Characteristics) of laser diode and light emitting diode.