

**B.E III Year (Electronics &  
Communication Engineering) Semester –  
VI**

<b>Theory</b>
MICROWAVE AND RADAR ENGINEERING
CONTROL SYSTEMS ENGG. (EL,EE, EEE)
MOS IC'S AND TECHNOLOGY (Common with 7 <sup>th</sup> Sem.- EI)
COMPUTER NETWORKS (EL,CSE, COMMON WITH V- SEM. – IT, AEI)
TV ENGINEERING
DIGITAL SYSTEM DESIGN (EL,EI, IC,EE,CSE, AEI)
<b>Practical</b>
CONTROL SYSTEMS ENGG. LAB (EL,EE, EEE, AEI)
NETWORK PROGRAMMING LAB (EL, IT, AEI)
DIGITAL SYSTEM DESIGN LAB
MICROWAVE LAB
GENERAL PROFICIENCY

## MICROWAVE AND RADAR ENGINEERING

### **Unit1. Waveguides:**

Introduction, comparison with transmission lines, propagation in TE & TM mode, rectangular wave guide, TEM mode in rectangular wave guide, characteristic impedance, introduction to circular waveguides and planar transmission lines.

### **Unit2 . Microwave Components:**

Directional couplers, tees, hybrid ring, S-parameters, attenuators, cavity resonators ,mixers & detectors, matched Load, phase shifter ,wave meter, Ferrite devices: Isolators, circulators.

### **Unit3. Microwave Tubes:**

Limitation of conventional tubes; Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT , BWO , crossed field amplifiers.

### **Unit4. Microwave Solid State Devices :**

Varactor diode, Tunnel diode, Schottky diode, GUNN diode, IMPATT, TRAPATT and PIN diodes. MASER, parametric amplifiers.

### **Unit5. Microwave Measurements :**

Power measurement using calorimeter & bolometers, measurement of SWR, frequency , wavelength and impedance. Microwave bridges.

### **Unit6. Introduction To Radar :**

Block Diagram and operation, Radar Frequencies, Simple form of Radar Equation, Prediction of Range Performance, Pulse Repetition frequency and Range Ambiguities, Applications of Radar

### **Text Books:**

1. Microwave devices and circuits :Samuel Liao;PHI
2. Microwave devices & Radar Engg :M .Kulkarni;Umesh

### **Reference Book :**

1. Microwaves and Radar : A.K. Maini; Khanna

## **CONTROL SYSTEM ENGINEERING**

### **Unit1. Introductory Concepts :**

System/Plant model, types of models, illustrative examples of plants and their inputs and outputs, controller, servomechanism, regulating system, linear time-invariant (LTI) system, time-varying system, causal system, open loop control system, closed loop control system, illustrative examples of open-loop and feedback control systems, continuous time and sampled data control systems. Effects of feedback on sensitivity (to parameter variations), stability, external disturbance (noise), overall gain etc. Introductory remarks about non-linear control systems.

### **Unit2. Mathematical Modelling :**

Concept of transfer function, relationship between transfer function and impulse response, order of a system, block diagram algebra, signal flow graphs : Mason's gain formula & its application, characteristic equation, derivation of transfer functions of electrical and electromechanical systems. Transfer functions of cascaded and non-loading cascaded elements. Introduction to state variable analysis and design.

### **Unit3. Time Domain Analysis :**

Typical test signals, time response of first order systems to various standard inputs, time response of 2nd order system to step input, relationship between location of roots of characteristics equation,  $\omega$  and  $\omega_n$ , time domain specifications of a general and an under-damped 2nd order system, steady state error and error constants, dominant closed loop poles, concept of stability, pole zero configuration and stability, necessary and sufficient conditions for stability, Hurwitz stability criterion, Routh stability criterion and relative stability.

### **Unit4. Root Locus Technique :**

Root locus concept, development of root loci for various systems, stability considerations.

### **Unit5. Frequency Domain Analysis :**

Relationship between frequency response and time-response for 2nd order system, polar, Nyquist, Bode plots, stability, Gain-margin and Phase Margin, relative stability, frequency response specifications.

### **Unit6. Compensation :**

Necessity of compensation, compensation networks, application of lag and lead compensation, basic modes of feedback control, proportional, integral and derivative controllers, illustrative examples.

### **Unit7. Control Components :**

Synchros, AC and DC techogenerators, servomotors, stepper motors, & their applications, magnetic amplifier.

### **Text Book :**

1. Control System Engineering : I.J.Nagrath & M.Gopal; New Age

### **Reference Books :**

1. Automatic Control Systems : B.C.Kuo, PHI.
2. Modern Control Engg : K.Ogata; PHI.
3. Control Systems - Principles & Design : Madan Gopal; Tata Mc Graw Hill.
4. Modern Control Engineering.R.C.Dorl & Bishop; Addison-Wesley

## MOS ICs AND TECHNOLOGY

### **Unit1. Review Of Mos Technology :**

Introduction to IC technology, MOS Transistor enhancement mode and depletion mode operations, fabrication of NMOS, CMOS and BiCMOS devices. Equivalent circuit for MOSFET and CMOS.

### **Unit2. Mos Transistor Theory:**

MOS device design equations, MOS transistor, Evaluation aspects of MOS transistor, threshold voltage, MOS transistor transconductance & output conductance, figure of merit, determination of pull-up to pull-down ratio for an n-MOS inverter driven by another n-MOS inverter & by one or more pass transistor, alternative forms of pull-up, CMOS and BiCMOS-inverters. Latch up in CMOS circuitry and BiCMOS Latch up susceptibility.

### **Unit3. Mos Circuits And Logic Design :**

Basic physical design of simple logic gates using n-MOS, p-MOS and CMOS, CMOS logic gate design considerations, CMOS logic structures, clocking strategies.

### **Unit4. Circuit Characterization And Performance Estimation :**

Resistance estimation, capacitance estimation, inductance, switching characteristics, CMOS gate transistor sizing, power dissipation.

### **Unit5. Vlsi Fabrication :**

Crystal growth, wafer preparation, epitaxy, oxidation, lithography, etching, diffusion, dielectric and poly-silicon film deposition, ion implantation, yield and reliability, metalization.

### **Unit6. Design Example Using Cmos :**

Incrementer / decremter, left/right shift serial/parallel register, comparator for two n-bit number, a two-phase non-overlapping clock generator with buffered output on both phases, design of an event driven element for EDL system

### **Text Books :**

1. Introduction to Digital Integrated Circuits : Rabaey, Chandrakasan & Nikolic.
2. Principles of CMOS VLSI Design : Neil H.E. Weste and Kamran Eshraghian; Pearson.

### **Reference Books :**

1. Introduction to Digital Circuits : Rabaey and .....LPE (PH)
2. ....: S.K.Gandhi.
3. VLSI Technology: S.M. Sze; McGraw-Hill.
4. Integrated Circuits: K.R. Botkar; Khanna

## Computer Networks

**Unit-1: OSI Reference Model and Network Architecture:** Introduction to Computer Networks, Example networks ARPANET, Internet, Private Networks, Network Topologies: Bus-, Star-, Ring-, Hybrid -, Tree -, Complete -, Irregular -Topology; Types of Networks : Local Area Networks, Metropolitan Area Networks, Wide Area Networks; Layering architecture of networks, OSI model, Functions of each layer, Services and Protocols of each layer

**Unit-2: TCP/IP:** Introduction, History of TCP/IP, Layers of TCP/IP, Protocols, Internet Protocol, Transmission Control Protocol , User Datagram Protocol, IP Addressing, IP address classes, Subnet Addressing, Internet Control Protocols, ARP, RARP, ICMP, Application Layer, Domain Name System, Email – SMTP, POP,IMAP; FTP, NNTP, HTTP, Overview of IP version 6.

**Unit-3: Local Area Networks:** Introduction to LANs, Features of LANs, Components of LANs, Usage of LANs, LAN Standards, IEEE 802 standards, Channel Access Methods, Aloha, CSMA, CSMA/CD, Token Passing, Ethernet, Layer 2 & 3 switching, Fast Ethernet and Gigabit Ethernet, Token Ring, LAN interconnecting devices: Hubs, Switches, Bridges, Routers, Gateways.

**Unit-4: Wide Area Networks:** Introduction of WANs, Routing, Congestion Control, WAN Technologies, Distributed Queue Dual Bus (DQDB), Synchronous Digital Hierarchy (SDH)/ Synchronous Optical Network (SONET), Asynchronous Transfer Mode (ATM), Frame Relay., Wireless Links.

**Unit-5: Introduction to Network Management:** Remote Monitoring Techniques: Polling, Traps, Performance Management, Class of Service, Quality of Service, Security management, Firewalls, VLANs, Proxy Servers, Introduction to Network Operating Systems: Client-Server infrastructure, Windows NT/2000.

### Text Book:

- Computer Networks (3rd edition), Tanenbaum Andrew S., International edition, 1996.

### Reference Books:

- Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred, 2000, Addison Wesley, Low Price Edition.
- Business Data Communications, Fitzgerald Jerry,.
- Computer Networks – A System Approach, Larry L. Peterson & Bruce S. Davie, 2<sup>nd</sup> Edition
- Computer Networking – ED Tittel , 2002, T.M.H.

## **TELEVISION ENGINEERING**

### **Unit1 Elements Of A Television System :**

Picture transmission, sound transmission, picture reception, sound reception synchronization, receiver controls, color television.

Analysis and Synthesis of Television Pictures: Gross structure, image continuity, no. of scanning lines, flicker, fine structure, tonal gradation.

### **Unit2. Composite Video Signal :**

Video signal dimensions, horizontal sync details, vertical sync details, scanning sequence details, functions of vertical pulse train, sync details of 525 line system.

### **Unit3. Signal Transmission And Channel Bandwidth :**

Amplitude Modulation, channel bandwidth, vestigial side band transmission, Transmission efficiency, complete channel bandwidth, reception of vestigial side band signals, frequency modulation, FM channel bandwidth, channel bandwidth for color transmission, allocation of frequency bands for television signal transmission, television standards.

### **Unit4. The Picture Tube :**

Monochrome picture tube, Beam deflection, screen phosphor, face plate, picture tube characteristics, picture tube circuit controls. Television Camera Tubes: Basic principal, Image orthicon, Vidicon.

### **Unit5. Basic Television Broadcasting:**

Television transmitter, positive & negative modulation.

Television Receiver: Receiver sections, vestigial side band correction, choice of intermediate frequencies, picture tube circuitry & controls, sound signal separation, sound section, Sync processing & AFC circuit, vertical Deflection circuit, Horizontal deflection circuit.

Television Signal propagation & Antennas: Television Transmission antennas , television receiver antennas, color television antennas.

**Unit6. Essentials Of Color Television:**

Compatibility, natural light, color perception, three color television camera, the luminance signal, values of Luminance & color difference signals on Colors, color television display tubes (Delta gun, PIL, Trinitron).

**Unit7. Color Signal Transmission And Reception :**

Color signal transmission, bandwidth for color signal transmission.

**Unit8. Television Applications:**

Cable television, CCTV, picture phone & facsimile, television via satellite, Remote Control ( Electronic control system ), Introduction to Digital TV Technology and their merits , HDTV.

**Text Book:**

Monochrome and Color Television : R.R.Gulati ; New Age.

**Reference Book :**

TV and Video Engineering : Dhake ; TMH.

## DIGITAL SYSTEM DESIGN

**Unit 1. Introduction :**

Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL, data objects, classes and data types, Operators, Overloading, logical operators. Types of delays Entity and Architecture declaration. Introduction to behavioural, dataflow and structural models.

**Unit 2. Vhdl Statements :**

Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements.

Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

**Unit 3. Combinational Circuit Design:**

VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders, code converters, comparators, implementation of Boolean functions etc.

**Unit 4. Sequential Circuits Design :**

VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

**Unit 5. Design Of Microcomputer :**

Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL

**Unit 6. Design With Cplds And Fpgas :**

Programmable logic devices : ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using

**Reference Books:**

1. IEEE Standard VHDL Language Reference Manual (1993).
2. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
3. "A VHDL Primmer" : Bhasker; Prentice Hall 1995.
4. "Digital System Design using VHDL" : Charles. H.Roth ; PWS (1998).
5. "VHDL-Analysis & Modelling of Digital Systems" : Navabi Z; McGraw Hill.
6. VHDL-IV Edition :Perry; TMH (2002)
7. "Introduction to Digital Systems" : Ercegovac. Lang & Moreno; John Wiley (1999).
8. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000)
9. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).

## CONTROL SYSTEM LAB

### List of Experiments:

1. To study A.C. servo motor and to plot its torque speed characteristics.
2. To study D.C. servo motor and to plot its torque speed characteristics.
3. To study the magnetic amplifier and to plot its load current v/s control current characteristics for :  
(a) series connected mode  
(b) parallel connected mode.
4. To plot the load current v/s control current characteristics for self excited mode of the magnetic amplifier.
5. To study the synchro & to:  
(a) Use the synchro pair (synchro transmitter & control transformer) as an error detector.  
  
(b) Plot stator voltage v/s rotor angle for synchro transmitter i.e. to use the synchro transmitter as position transducer.
6. To use the synchro pair (synchro transmitter & synchro motor) as a torque transmitter.
7. (a) To demonstrate simple motor driven closed loop position control system.  
(b) To study and demonstrate simple closed loop speed control system.
8. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots .
9. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.
10. To implement a PID controller for level control of a pilot plant.
11. To implement a PID controller for temperature control of a pilot plant.
12. To study the MATLAB package for simulation of control system design.

## **Network Programming Lab.**

**The socket programming can be done on Unix/Linux operating or/and Windows. Socket programming, and the language can be C/VC++ and/or Java**

1. Write a program to Create Sockets For Sending And Receiving Data.
2. Write a program to Obtain The Local & Remote Socket Address.
3. Write a program to Create Sockets For Handling Multiple Connection
4. Write a program to Obtain The Information About The (A) Host (B) Network (C) Protocols (D) Domains
5. Write a program to Manipulate The IP Address.
6. Write a program to Write A Telnet Client.
7. Write a program to Make An FTP Client

## DIGITAL SYSTEM DESIGN LAB

### List of Experiments:

1. Design all gates using VHDL.
2. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
  - a. half adder
  - b. full adder
3. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
  - a. multiplexer
  - b. demultiplexer
4. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
  - a. decoder
  - b. encoder
5. Write a VHDL program for a comparator and check the wave forms and the hardware generated
6. Write a VHDL program for a code converter and check the wave forms and the hardware generated
7. Write a VHDL program for a FLIP-FLOP and check the wave forms and the hardware generated
8. Write a VHDL program for a counter and check the wave forms and the hardware generated
9. Write VHDL programs for the following circuits, check the wave forms and the hardware generated
  - a. register
  - b. shift register
10. Implement any three (given above) on FPGA/CPLD kit

## MICROWAVE LAB

### List of Experiments :

1. Study of wave guide components.
2. To study the characteristics of reflex Klystron and determine its timing range.
3. To measure frequency of microwave source and demonstrate relationship among guide dimensions, free space wave length and guide wavelength.
4. To measure VSWR of unknown load and determine its impedance using a smith chart.
5. To match impedance for maximum power transfer using slide screw tuner.
6. To measure VSWR, insertion losses and attenuation of a fixed and variable attenuator.
7. To measure coupling and directivity of direction couplers.
8. To measure insertion loss, isolation of a three port circulator.
9. To measure the Q of a resonant cavity.
10. To study the V-I characteristics of GUNN diode.