EC-501 Voice and Data Communication

Unit I

Telephone instruments and signals

Introduction, the subscriber loop, standard telephone set, basic call procedure, call progress tones and

signals, cordless telephones, caller identification, electronic telephones.

Telephone circuit

Introduction, the local subscriber loop, channel noise and units of power measurements, transmission

parameters, voice frequency circuit arrangements, crosstalk.

Unit II

Public telephone network

Introduction, transmission system environment, public telephone network, instruments, local loops, trunk

circuits, – local central and operator-assisted exchanges, automated central office switches and exchanges,

telephone numbering plan, telephone services, telephone switching hierarchy, common channel signaling

system.

Multiplexing of telephone channels

Introduction, time division multiplexing, T1 digital carrier, digital hierarchy, digital carrier line encoding, T

carrier systems, digital carrier frame synchronization, bit versus word interleaving, statistical TDM, codecs

and combo chips, frequency division multiplexing, FDM hierarchy, composite baseband signal, formation of

master group, wavelength division multiplexing.

Unit III

Multiplexing of telephone channels

Introduction, time division multiplexing, T1 digital carrier, digital hierarchy, digital carrier line encoding, T

carrier systems, digital carrier frame synchronization, bit versus word interleaving, statistical TDM, codecs

and combo chips, frequency division multiplexing, FDM hierarchy, composite baseband signal, formation of

mastergroup, wavelength division multiplexing.

Unit IV

Data Communications

Components, protocols and standards, standards organizations, line configuration, topology, transmission

mode, digital signals, digital to digital encoding, digital data transmission, DTE-DCE interface, interface

standards, modems, cable modem, transmission media- guided and unguided, transmission impairment,

performance, wavelength and Shannon capacity.

Unit V

Error detection and correction

Types of error, error detection- redundancy check (longitudinal, vertical and cyclic), checksum, error

correction-hamming code.

Switching

Circuit switching (space-division, time division and space-time division), packet switching (virtual circuit and

datagram approach), message switching.

References:

1. Tomasi: Advanced Electronic Communication Systems, PHI Learning.

2. Forouzan: Data Communications and Networking, TMH.

3. Tomasi: Introduction to Data Communication Systems, Pearson Education.

4. William Stallings: Data and Computer Communications, Pearson Education

5. Brijendra Singh: Data Communications and Networks, PHI Learning.

EC- 502 Control Systems

Unit-I

Control system

Terminology and classification of control system, examples of control system, mathematical modeling of

mechanical and electrical systems, differential equations, block diagram representation and reduction,

signal flow graph techniques.

Feedback characteristics of control systems

Feedback and non-feedback systems, reduction of parameter variations by use of feedback, control over

system dynamics and effects of disturbances by the use of feedback, linearization effect of feedback,

regenerative feedback.

Unit-II

Time response analysis

Standard test signals, time response of 1st order system, time response of 2nd order system, steady-state

errors and error constants, effects of additions of poles and zeros to open loop and closed loop system.

Time domain stability analysis

Concept of stability of linear systems, effects of location of poles on stability, necessary conditions for

stability, Routh-Hurwitz stability criteria, relative stability analysis, Root Locus concept, guidelines for

sketching Root-Locus.

Unit-III

Frequency response analysis

Correlation between time and frequency response, Polar plots, Bode Plots, all-pass and minimum-phase

systems, log-magnitude versus Phase-Plots..

Frequency domain stability analysis

Nyquist stability criterion, assessment of relative stability using Nyquist Criterion (phase margin, gain margin

and stability), closed-loop frequency response.

Unit-IV

Approaches to system design

Design problem, types of compensation, design of phase-lag, phase lead and phase lead-lag compensators

in time and frequency domain, proportional, derivative, integral and PID compensation.

Digital control systems

System with digital controller, difference equations, the z-transform, pulse transfer function, inverse ztransform,

the s and z domain relationship.

Unit-V

Concept of state, state variables and state model,

State space representation of systems, block diagram for state equation, transfer function decomposition,

solution of state equation, transfer matrix, relationship between state equation and transfer function,

controllability and observability.

References:

1. Nagrath and Gopal: Control System Engineering, New Age International Publishers.

2. Kuo: Automatic Control Systems, PHI Learning.

3. Varmah: Control Systems, TMH.

4. Distefano (Schaum series): Control Systems, TMH

5. Manke: Linear Control System, Khanna Publishers.

6. Stefani, Shahian: Design of feedback control systems, Oxford University Press.

7. Ogata: Modern Control Engineering, PHI Learning.

EC- 503 Digital Communications

Unit-I

Random variables

Cumulative distribution function, Probability density function, Mean, Variance and standard deviations of random

variable, Gaussian distribution, Error function, Correlation and autocorrelation, Central-limit theorem, Error probability,

Power Spectral density of digital data.

Unit-II

Digital conversion of Analog Signals

Sampling theorem, sampling of band pass signals, Pulse Amplitude Modulation (PAM), types of sampling

(natural, flat-top), equalization, signal reconstruction and reconstruction filters, aliasing and anti-aliasing

filter, Pulse Width Modulation (PWM), Pulse Position Modulation (PPM).

Digital transmission of Analog Signals

Quantization, quantization error, Pulse Code Modulation (PCM), companding, scrambling, TDM-PCM,

Differential PCM, Delta modulation, Adaptive Delta modulation, vocoders.

Unit-III

Digital Transmission Techniques

Phase shift Keying (PSK)- Binary PSK, differential PSK, differentially encoded PSK, Quadrature PSK, M-ary

PSK.Frquency Shift Keying (FSK)- Binary FSK (orthogonal and non-orthogonal), M-ary FSK.

Comparison of BPSK and BFSK, Quadrature Amplitude Shift Keying (QASK), Minimum Shift Keying (MSK).

Unit-IV

Other Digital Techniques

Pulse shaping to reduce inter channel and inter symbol interference- Duobinary encoding, Nyquist criterion

and partial response signaling, Quadrature Partial Response (QPR) encoder decoder.

Regenerative Repeater- eye pattern, equalizers.

Optimum Reception of Digital Signals

Baseband signal receiver, probability of error, maximum likelihood detector, Bayes theorem, optimum

receiver for both baseband and passband receiver- matched filter and correlator, probability of error

calculation for BPSK and BFSK.

Unit-V

Information Theory

Source Coding: Introduction to information theory, uncertainty and information, average mutual information

and entropy, source coding theorem, Huffman coding, Shannon-Fano-Elias coding,

Channel Coding: Introduction, channel models, channel capacity, channel coding, information capacity

theorem, Shannon limit.

References:

1. Taub and Schilling: Principles of Communication Systems, TMH.

2. Lathi: Modern Digital and Analog Communication Systems, Oxford University Press.

3. Simon Haykins: Communication Systems, John Wiley.

4. Ranjan Bose: Information Theory, Coding and Cryptography, TMH.

5. Das, Mallik, Chatterjee: Principles of Digital Communication, New Age International

6. Skylar and Ray: Digital Communications, Pearson Education.

7. Rao: Digital Communications, TMH.

List of Experiments:

1. Study of Sampling Process and Signal Reconstruction and Aliasing.

2. Study of PAM, PPM and PDM.

3. Study of PCM Transmitter and Receiver.

4. Time Division Multiplexing (TDM) and Demultiplexing.

5. Study of ASK, PSK and FSK Transmitter and Receiver.

EC- 504 Microprocessors and Microcontrollers

Unit I

Architecture of 8086 Microprocessor

BIU and EU, register organization, pin diagram, memory organization, clock generator 8284, buffers and

latches, 8288 bus controller, maximum and minimum modes.

Unit II

Assembly Language Programming of 8086

Instruction formats, addressing modes, instruction set, assembly language programming, ALP tools-editor,

assembler, linker, locator, debugger, emulator.

8086 based multiprocessor systems

Interconnection topologies, coprocessors 8087 NDP, I/O processors 8089 IOP, bus arbitration and

control, lightly and tightly coupled systems.

Unit III

Peripheral devices and their interfacing

Memory interfacing, Programmable input/output ports 8255, Programmable interval timer 8253, keyboard/

display controller 8279, CRT controller 8275, Programmable communication interface 8251 USART.

Unit IV

Interrupts of 8086

Interrupts and interrupt service routine, interrupt cycle, maskable and non-maskable interrupts, interrupt

programming. Programmable interrupt controller 8259.

DMA in 8086

Basic DMA operation, modes of DMA transfer, DMA controller 8257.

Unit V

8051 Microcontroller

Features, architecture, Pin Diagram, memory organization, external memory interfacing, instruction syntax,

data types, subroutines, addressing Modes, instruction set, ALP of 8051. Applications of 8051.

References:

1. Ray and Bhurchandi: Advanced microprocessors and peripherals, TMH.

2. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.

3. Senthil Kumar: Microprocessors and interfacing, Oxford University press.

4. Bahadure: Microprocessors 8086 and Pentium family, PHI Learning.

5. Udayashankara and Mallikarjunaswamy: 8051 Microcontroller, TMH.

6. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education

7. D. V. Hall: Microprocessors and Interfacing, TMH.

List of Experiments:

1. Assembly Language Programs of Microprocessor 8086.

2. Assembly Language Programs of Microcontroller 8051.

3. Assembly Language Programs for Interfacing Chips.

EC– 505 Communication Networks and Transmission Lines

Unit I

Characteristic Parameters of symmetrical and asymmetrical two port networks and their design

Image impedance, iterative impedance, characteristic impedance, propagation coefficient, image transfer

coefficient , iterative transfer coefficient, Lattice and Bridged T networks, reactive matching networks,

matching techniques, insertion loss, symmetrical and asymmetrical attenuators and their design.

Unit II

Passive LC Filters

Analysis and design of Low pass, high pass, band pass and band elimination filters, m-derived filters,

composite filters, Filter specifications, Butterworth approximation, Chebyshev approximation, elliptic

function approximation, frequency transformation.

Unit III

Positive real function

LC, RL, RC, and RLC network synthesis, Foster and Cauer network, minimum positive real function,

Brune's method, Bott-Duffin method, Synthesis-Coefficient.

Unit IV

Transmission line fundamentals

Lumped parameter equivalent, voltage and current on a transmission line, infinite line, characteristic

impedance and propagation constant, waveform distortion, attenuation and phase equalizers, distortion-less

line, loading, liner reflection on a line, reflection coefficient, input and transfer impedances, open circuit and

short circuit line, reflection factors, reflection loss, insertion loss, T and π equivalents of a line, location of

line fault, construction and design of two wire line and coaxial cable.

Unit V

Line at radio frequencies

Parameters of line and coaxial cable at radio frequencies, dissipation-less line, voltage and current on a

dissipation-less line, standing waves, standing wave ratio, input impedance of open circuit and short circuit,

power and impedance measurement on lines, eighth-wave, quarter-wave and half wave line, circle diagram,

Smith chart, solution of problems using Smith chart, single and double stub matching .introduction to microstrip

lines and its analysis.

References:

1. Ryder: Networks and Transmission Lines, PHI Learning.

2. Valkenberg: Introduction to Modern Network synthesis, Wiley India.

3. Suresh: Electric Circuits and Networks, Pearson Education.

4. Raju: Electromagnetic field theory and Transmission Lines, Pearson Education.

5. Ganesan: Transmission Lines and Waveguides, TMH.

6. Rao: Electromagnetic Waves and Transmission Lines, PHI learning.

List of Experiments:

1. To set up the standing waves formation on a transmission line and observe their maxima and minima using frequency domain method.

2. To measure the characteristic impedance of transmission lines using frequency domain method and to differentiate between the matched and unmatched lines.

3. To measure the VSWR, reflection coefficient and return loss in a transmission line.

4. To measure the dielectric constant of insulator in the transmission line.

5. To measure the velocity of propagation and wavelength in the given transmission line.

6. To study the attenuation characteristics of signal along a transmission line and observe its variation with frequency. Also calculate the phase constant and propagation constant.

7. To study the effect of reactive loads on transmission lines.

8. To study the difference between lossy and loss less line.

9. To study the physical dimensions of transmission line and estimation of characteristic impedance.

10. To study behavior of infinite and short lines.

11. To study the operation of Balun transformer.

12. To study the loading of transmission lines and estimate the cut off frequency of a loaded line.

13. To study the use of coaxial lines as tuned circuits and delay lines.

14. To study the input and output impedance of any RF circuits and match it to 50/75 ohms.

15. Simulation of various filters

EC– 506 Software Lab-III

Study of simulation software (any one Scilab/ MatLab etc.)

Introduction to Scilab / Matab, Study of Scilab / Matlab programming environment, Modeling, Design and

development of Programs.

Overview and Study of the key features and applications of the software.

Application of the software in the field of Control Systems, Data Communications and Communication

Systems.

1. Programs Related to Control System- open-loop and closed loop control system, frequency

response plots, determining transient response, specifications of second order system, effect of PID

controller on control system, Bode plot, Nyquist plot and Root Locus plot, state space analysis.

2. Programs Related to Communication Systems–Simulation of a Communication System

(Generation, addition of noise and Detection), AM, FM, PM, PAM, PCM, PSK, FSK etc.

3. Programs related to Data Communications- simulations of CRC, LRC, VRC, hamming codes, line

encoding techniques.

References:

1. Rudra Pratap: Getting Started with MATLAB, Oxford University Press.

2. http://www.scilab.in

3. http://ekalavya.it.iitb.ac.in/contents.do?topic=Scilab

4. Vinu V. Das: Programming in Scilab, New Age Publisher.

5. Chapman Stephen J.: MATLAB Programming for Engineers, Thomson Cengage

6. Proakis: Contemporary Communication System Using MATLAB; Thomson Cengage.

7. Kuo: Automatic Control Systems, PHI Learning.

8. Singh and Chaudhari: Matlab Programming, PHI Learning